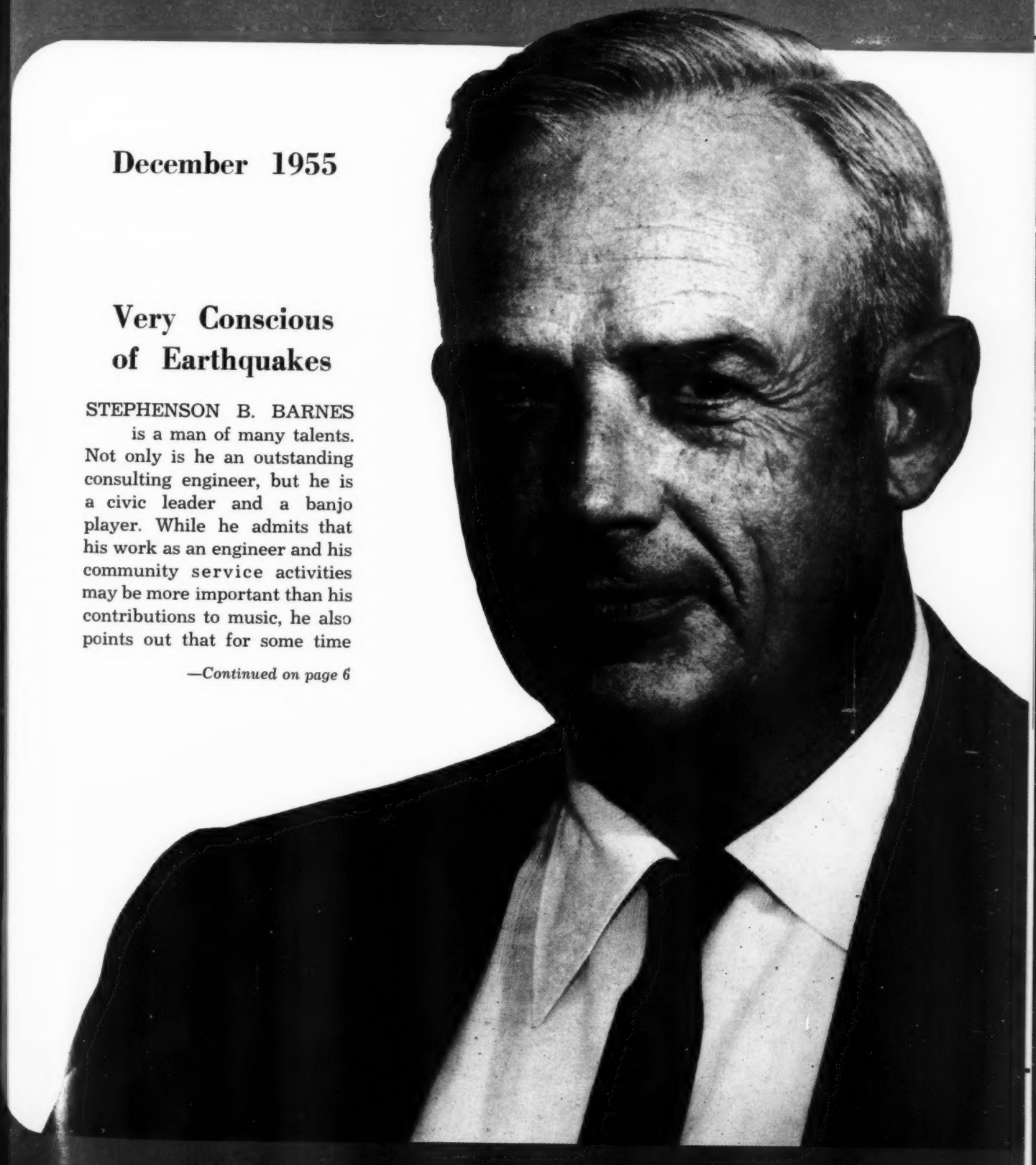
consulting engineer

December 1955



Very Conscious of Earthquakes

STEPHENSON B. BARNES is a man of many talents. Not only is he an outstanding consulting engineer, but he is a civic leader and a banjo player. While he admits that his work as an engineer and his community service activities may be more important than his contributions to music, he also points out that for some time

—Continued on page 6

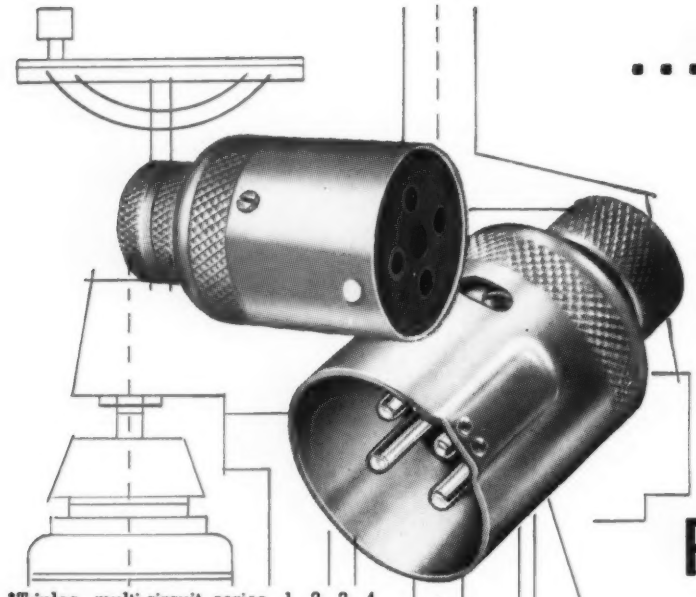
The Consulting Engineer's Professional Magazine

...for Motorized Valves

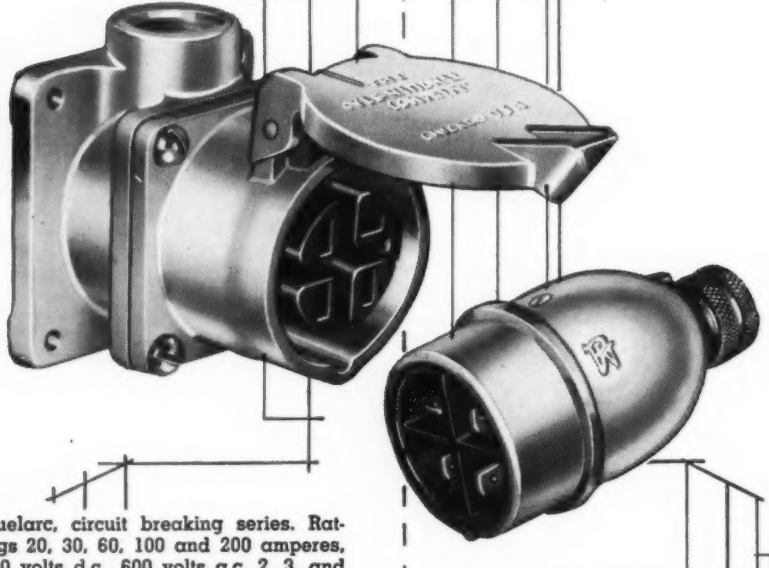
PYLE-NATIONAL

PLUGS and RECEPTACLES

- *Shorten out-of-service time*
- *Assure proper reconnection*
- *Save time and labor*



*Triploc, multi-circuit series. 1, 2, 3, 4, 6, 8, and 12 pole contact units interchangeable and reversible in any single set of housings. Housings of pressed steel with automatic lock or of cast metal threaded for watertight gasket seal. 2, 3 and 4 gang unit types for up to 48 poles also available.



*Quelarc, circuit breaking series. Ratings 20, 30, 60, 100 and 200 amperes, 250 volts d.c., 600 volts a.c. 2, 3, and 4 pole. Threaded cap, plain and hinged spring door housings.

*Trademark Reg. U.S. Pat. Off.

Pyle-National's safe, easy-to-handle heavy-duty plugs and receptacles quickly pay for themselves when used for connecting motorized valves or any other electrical equipment that must ever be relocated or disconnected for inspection or repair.

These prepolarized connectors not only eliminate the labor expense involved in disconnecting individual wires from junction boxes (or breaking soldered connections) and marking wires and terminals, but in addition, cut to a minimum the length of time valuable equipment is kept out of service.

The multiple-pole TRIPLOC series will handle any combination of power and control circuits. The heavy-duty QUELARC series will handle loads up to 200 amperes. Indeed, there is a Pyle connector for every application, including an explosion proof series for hazardous locations. Write for detailed literature.

Sold nationally through electrical distributors

THE PYLE-NATIONAL COMPANY

1337 North Kostner Avenue, Chicago 51, Illinois

BRANCH OFFICES AND AGENTS in principal cities of the United States and Canada
EXPORT DEPARTMENT: International Rail Supply Co., 30 Church St., New York
CANADIAN AGENT: The Holden Co., Ltd., Montreal

SINCE 1897

CONDUIT FITTINGS • FLOODLIGHTS • TURBO-GENERATORS • GYRALITES • MULTI-VENT AIR DISTRIBUTION

VOLUME 6 NUMBER 6

NBP Published by BPA

Consulting Engineer Publishing Co.
227 Wayne St., St. Joseph, Mich.

EDITORIAL

Hunter Hughes

A. M. Steinmetz

J. C. Dean

F. E. DeWolff

F. D. Hirschfeld—Zurich, Suisse

ART

Len Sentowski

Jack Knuth

PUBLISHER

E. R. Gauley

BUSINESS MANAGER

F. C. Donohue

CIRCULATION

E. C. Kelm

SALES MANAGER

O. DeWitt Young

SALES REPRESENTATIVES

(See page 92)

The Engineering Index Service in Public Libraries lists articles from CONSULTING ENGINEER

CONSULTING ENGINEER is published monthly at 227 Wayne St., Saint Joseph, Mich. Price 1 year $10.00; foreign $15.00; single copy $1.00. Accepted as Controlled Circulation Publication at Saint Joseph, Michigan. Send Form 3579 to Saint Joseph, Mich. Copyright 1955 Consulting Engineer Publishing Co.

consulting engineer®

December 1955

FEATURE ARTICLES

Disposal of Radioactive Waste

Part 1 . . . The U. S. Approach 36
Bernard Manowitz

Part 2 . . . The British Approach 41
Leo Walter

Dutch Consultants Cooperate on Foreign Jobs 45
Fritz Hirschfeld

Solving Tall Chimney Design Problems 48
M. Zar

Hydraulic Elevators and Modern Building Design 52
Floyd E. Willison

Consulting Engineers Meet in St. Louis 56
Staff Report

DEPARTMENTS

Personality — Stephenson B. Barnes . . . . . Front Cover
Readers' Comment 12
Economic News Notes — *E. F. MacDonald* 16
Scraps and Shavings 18
The Legal Aspect —*Melvin Nord* 21
Atoms in Action 32
Report From Madrid — *Fritz Hirschfeld* 68
News 72
Men in Engineering 76
Notes From Abroad 78
Books 86
Meetings 88
CONSULTING ENGINEER Editorial Index, 1955 89
Advertisers' Index 92

The Consulting Engineer's Professional Magazine

S. B. Barnes

—Starts on front cover

after he got out of Purdue University, he made $135 a month in engineering work during the day, and $300 a month playing the banjo at night. Since that time he has never underestimated the value of musical talent in an engineer.

Barnes was also a good amateur tennis player in his high school and college days. Just as others before him and many since, he recognized the advantages of living in Los Angeles, and moved there permanently after getting his degree in Civil Engineering from Purdue.

Earthquake Design

Barnes has another specialty—earthquake resistant diaphragms. It is not uncommon to hear Barnes referred to by other engineers in California as "Mr. Diaphragm."

"Earthquakes have had a lot to do with structural engineering in California," says Barnes, "and I have had a lot to do with earthquakes. Not causing them, you understand, but in designing buildings to withstand them.

"Earthquakes have influenced greatly the practice of Civil and Structural engineering in California. The adoption of the Field Act and the Riley Act by the State Legislature in 1934 makes it mandatory to design buildings to resist lateral forces.

"This is reflected in examinations given by the State Board of Registration for Civil and Professional Engineers. A Civil Engineer may practice all phases of civil engineering in California, including structural engineering, except in the design of school buildings where a Structural Engineer is required by the Field Act. To have the authority to use the title Structural Engineer, a registered Civil Engineer must pass another examination. We are very conscious of our earthquakes, and especially our schools are designed to withstand them.

"It should be mentioned, however, that some of the worst earthquakes in the more remote past have occurred in the central and southern parts of the United States.

Special Condition in California

"We do feel that California has a special condition, and that is one of the reasons we do not have reciprocal registration, as such, with other states. It is conceivable that an excellent structural engineer from another part of the country, a man with a good record of achievement, might not be a good risk for California registration simply because he does not have experience in designing for extreme lateral forces. That is not too much of a handicap, however, for a little study will overcome that deficiency in an otherwise good engineer, and we usually give individual examinations if applicants have passed a written examination in other states.

"I have now been a member of the California Board of Registration for two years. From this experience and from the gripes expressed, I have been impressed with the desirability, from the young engineer's point of view, of taking the Engineer-in-Training examination immediately after graduation. All too often, years pass before the man realizes that he needs to be registered. He has been specializing in one field and is then faced with the necessity of special study to prepare for the examination that covers the fundamentals in a broad field. It is possible that engineering schools in each state should require an examinee to pass this examination as a requirement for a degree.

Civil and Structural Registered

"There is another way in which our California Registration Law differs from many other states. We register Mechanical, Electrical, Chemical and Petroleum engineers but they are not licensed to practice. This means that only Structural and Civil Engineers are actually required to have a license and to sign or seal their plans. The other branches can register if they so desire, and they can then legally call themselves Professional Engineers, but they need not be registered to practice. Perhaps this is not a good arrangement, and considerable study is being given to it by the Registration Board, the various engineering societies, and the legislature.

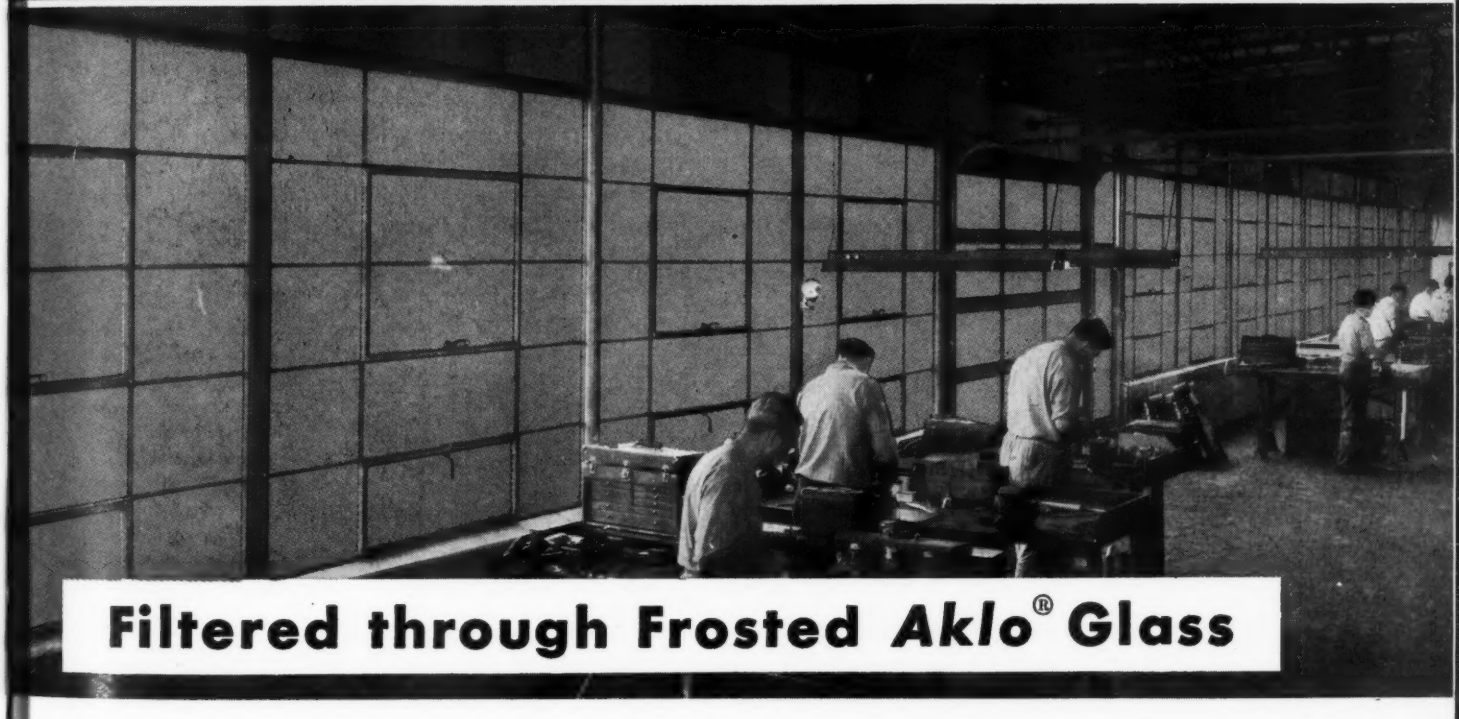
"Public safety has been the important consideration behind the current legislation, and until now the Structural and the Civil Engineers apparently have been the ones the legislature felt were most involved in public safety. But now, many of us recognize that with the increased importance of the electrical and mechanical aspect of buildings and equipment, there is good reason to require Electrical, Mechanical, and perhaps Chemical Engineers to be registered if they are offering their engineering services to the public. The question is where to stop. I cannot see, for example, where the work of a consulting tool engineer, or a consulting industrial designer or a management engineer necessarily involves the public safety. We do not want to require these men to register simply because they deal in some phase of engineering work. Registration or licensing must be for public protection. Any protection of the profession must be incidental.

"I think, however, that we will have required registration and licensing for the principal branches of engineering before long.

"On the other hand, we only require six years experience for registration, of which four can be in college. Most other states demand eight years experience, and I think we should, too. That change may be made in the next legislature.

"It is now, more than ever before, important that

Plenty of Daylight...

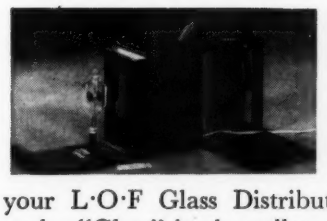


Filtered through Frosted *Aklo*® Glass

...best light for good workmanship

This blue-green glass softens and diffuses direct sunlight and sky brightness, as well as dazzling reflections from bright surroundings. Better seeing and better workmanship are natural results.

Aklo Glass cuts down sun heat, too. Used in ¼" thickness, it shuts out as much as 44% of the sun's radiant heat. Workers are more comfortable. Floor space close to windows is more usable.



Phone for this test
A call will bring a radiometer demonstration kit to your desk. It shows you how *Aklo* Glass reduces glare and sun heat. Call your L·O·F Glass Distributor or Dealer—he's listed under "Glass" in the yellow pages of your phone book. Or write to Libbey·Owens·Ford Glass Company, 608 Madison Avenue, Toledo 3, Ohio.

BLUE RIDGE
AKLO GLASS

BLUE RIDGE GLASS

FILTERS DAYLIGHT

L·O·F GLASS

we have good engineering registration laws and enforce them. We, here in California, are noticing a trend that is probably general throughout the nation. This is the trend toward a more important role for consulting engineers on major projects. We have in the past, as have many consultants, been engaged by the architect on the project. Now we find it more and more common to engage in joint ventures with the architect in which we are both employed by the client on an equal footing. Sometimes, where the engineering features of a project are paramount, the situation is the reverse of the old system, and we deal directly with the client, and the architect is then employed by us. On such projects the consulting engineer is no longer secondary to the architect. So much of the client's money is going into engineering features rather than into purely architectural aspects, that it is natural for the paramount consultant to take the top position. But this condition does, as I say, make it important that we have good registration laws and enforce them for the safety of the public and the satisfaction of the client.

"When the engineer recognizes that he is, through registration, a professional man with a duty to the public, he should then also recognize that he owes the public more than the layman. All too few engineers accept fully their civic responsibilities. I know that consultants are busy men, and we cannot give more time than we have, but every man has some time he can spare for civic activity. If all engineers are not endowed with an extroverted personality that makes them enthusiastic members of clubs, that does not mean that they are excluded from worth-while activity. There are other ways in which the engineer can be useful and apply his special knowledge. I have served, for example, for 16 years on the County Board of Appeals on Building Laws. I have been on the Advisory Board to the Division of Architecture of the State. In jobs like these, engineers are needed.

"While other engineers may not agree with me, I have also gained a lot from other types of civic activity. I have served on the Board of Directors of the Los Angeles Chamber of Commerce, and I have been an active member of the Rotary Club. It is my feeling that this type of civic activity not only is of personal value to the engineer, but it calls the attention of the public to consulting engineering. By associating with these men in other fields, we can bring to their attention the type of work we do. Soon they know what a consulting engineer is, and they recognize him as a professional man in private practice—as is the doctor or the lawyer.

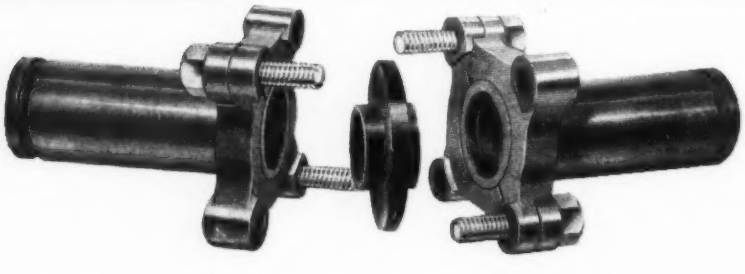
"Certainly, this is an ethical manner in which to educate the public while at the same time serving our communities.

"Incidentally, I played the banjo at the recent Convention of the Structural Engineers Association of California at Yosemite. My banjo playing is getting as rusty as my tennis." ▲▲

Gaco

RUBBER - LINED SYSTEM

SIMPLIFIES YOUR PIPING PROBLEMS . . .



1. ELIMINATES DESIGN ENGINEERING . . .
Rubber-lined pipe can be cut to size and installed at the job site from a sketch of the installation.

2. 360° ROTATION . . .
Flexibility of the free turning GACO split flange principle assures that every installation will line up on the job. The GACO flange hole pattern rotates around the pipe, conforming to all standard, rubber-lined fittings.

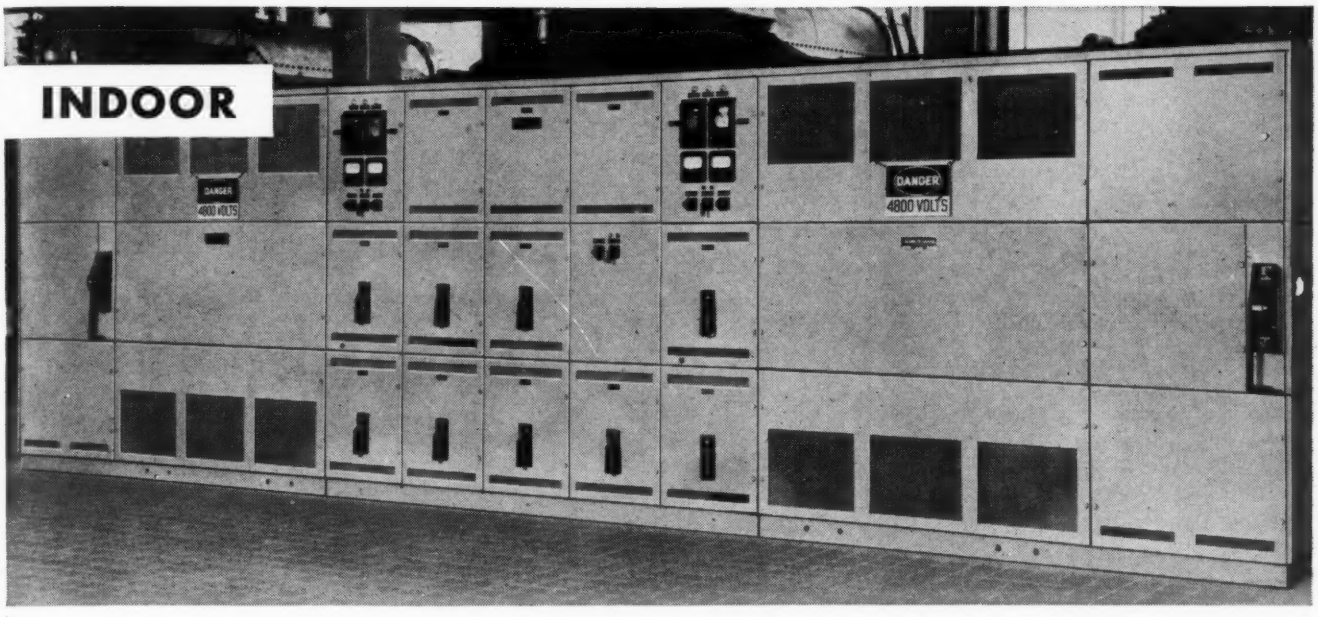
3. FOUR WAY SEALING . . .
GACO rubber gasket has a four-way sealing feature, giving leakproof service up to 1600 pounds pressure and 28″ vacuum.

4. UNINTERRUPTED FLOW . . .
The GACO joint presents uninterrupted flow to the liquid stream through the entire GACO pipe system.

The GACO split flange is the ultimate in engineering simplicity. Pipe is prepared for joining by grooving ends and counterboring rubber lining. Rubber gasket is fitted into the pipe ends. Split flanges are wrapped around grooved pipe section and bolted together to complete the assembly of the GACO joint. The GACO System is adaptable to any type of rubber-lined pipe installation.

Save time and reduce costs on piping installations and repairs.
Write for a copy of GACO Rubber Lined Pipe System catalog today.

GATES ENGINEERING COMPANY • WILMINGTON 99, DELAWARE



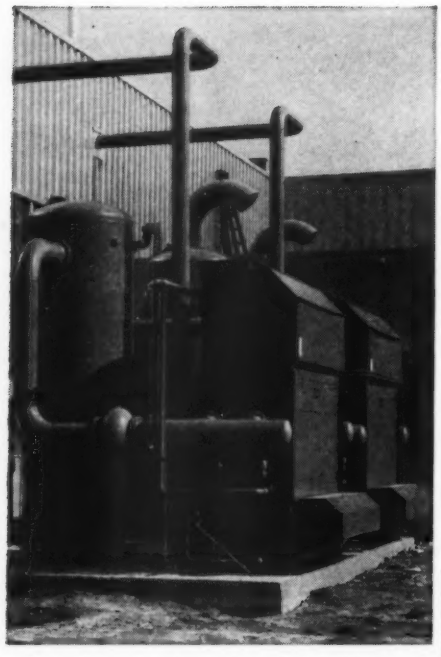
I-T-E, single source of supply for complete Unit Substations

You can buy a unit substation either of two ways: a piece at a time (the expensive way), or all at once (the economical way). I-T-E can sell you the individual elements, but recommends that substations be purchased complete, and from a single source of supply.

This way, you get more value from I-T-E's engineering assistance in over-all planning. The unit substation, including primary breakers or switches, liquid or dry type transformers, and secondary distribution switchgear with air circuit breakers, is assembled, tested and shipped as a unit ready for immediate installation. You have one dependable company that stands behind your complete installation.

I-T-E Primary and Secondary Unit Substations can be supplied for any application indoor or outdoor, and in any standard rating. For details, contact the I-T-E sales office nearest you. Look in your classified directory under "Electric Equipment." I-T-E Circuit Breaker Company, Switchgear Division, 19th & Hamilton Sts., Philadelphia 30, Pa.

I-T-E CIRCUIT BREAKER COMPANY, Switchgear Division



This Niagara Aero After Cooler also cools compressor jacket and intercooler water.

COMPRESSED AIR
• Lower in Cost
• Drier and Cooler

THE NIAGARA *AERO* AFTER COOLER offers a completely self-contained method replacing both shell-and-tube cooler and cooling tower. It is independent of a large supply of cooling water and consistently reduces compressed air temperatures to below ambient.

Drier air gives you better operation and lower costs in using all air-operated automatic instruments, tools and machines, paint spraying, sand blasting and moisture-free air cleaning.

Direct saving in the cost of cooling water saves the price of the Niagara *Aero* After Cooler in less than two years.

Niagara *Aero* After Cooler assures all these benefits because it cools compressed air or gas below the temperature of surrounding atmosphere; there can be no further condensation in your air lines. It condenses the moisture by passing the air through a coil on the surface of which water is evaporated, transferring the heat to the atmosphere. It is installed outdoors, protected from freezing in winter, proven in service on the largest plant utility systems.

Write for Bulletin No. 130

NIAGARA BLOWER COMPANY
Dept. C.O., 405 Lexington Ave.
NEW YORK 17, N. Y.
District Engineers in
Principal Cities of U. S. and Canada

READERS' COMMENT

Should P.E.'s Advertise?

Sir:

I want to compliment you and your staff for the excellent presentation of my article on advertising. ("Should Professional Engineers Advertise?" Nov., p. 60.) I was about to board the usual commuter's special when one of my neighbors greeted me with the salutation that he had clipped the article and was going to use it as part of his presentation to top management on why his firm should advertise. He added that next year will be their sixtieth year and as yet they have done no advertising.

I recommended that they use the sixtieth anniversary year as their key note for an advertising program. . . .

Richard L. Moore, Director
Public Relations Department
Foster D. Snell, Inc.
New York City

Sir:

Since I need all the help I can get, this is a copy of a letter I wrote Mr. Richard L. Moore, who wrote an article in your November issue. "Dear Mr. Moore:

Thank you for your thought-provoking article, 'Should Consulting Engineers Advertise?' I have been working on an engineering account for several months now, and I have great hopes in your article helping me land it.

I am not an engineer, and have never handled industrial accounts; however, neither have I been a merchant, manufacturer or distributor and I never let that stop me before. One thing bothers me—it is easy to find out what your competition is doing in other lines of business, but I have found it fairly difficult to ferret ads and campaigns of engineers. Do you know where I could find reprints or samples of consulting engineer advertisements?

Thanks, also, for listing a simple promotion program."

Joe Rosien
Public Relations, Advertising
Dallas, Texas

Interest in Ethics

Sir:

I have enjoyed my copies of CONSULTING ENGINEER very much. There are many timely and pertinent articles.

I would like to have permission to reproduce the editorial under "Scraps and Shavings" in the November issue. These copies would be given to other engineers only.

Harold A. Kelley, Treasurer
Toledo Society of Professional Engineers
Toledo, Ohio

• PERMISSION GRANTED.

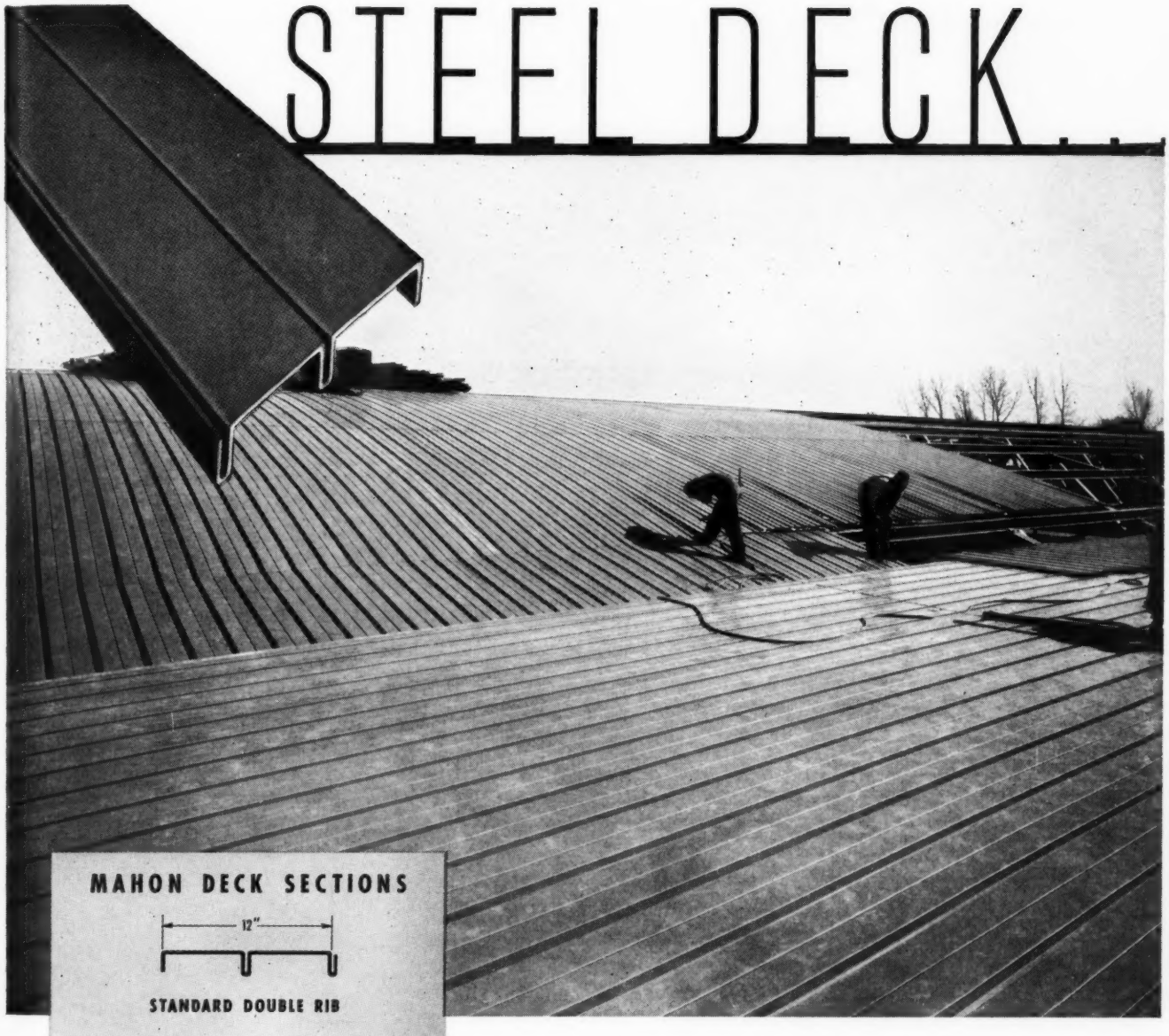
Science, Not Sorcery

Sir:

We have read the article "Soil Mechanics is a Science" in your October issue with interest and appreciation.

It is sometimes very difficult to convince a client that Soil Mechanics is indeed a science rather than an art or guessing game. Part of the problem is due to the fact that many of the practitioners in this field have developed what might best be termed an individual approach to the solution of a particular type problem. In presenting such an approach, the impression is sometimes left that other approaches are incorrect. Thus a client often gains the impression that the field of Soil Mechanics is peopled with self-appointed experts, none of whom agree with each other. No wonder the non-engineer sometimes has

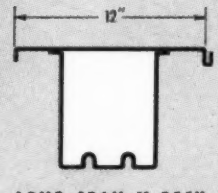
STEEL DECK . . .



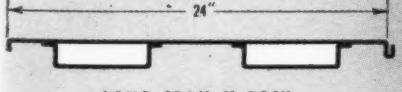
MAHON DECK SECTIONS

STANDARD DOUBLE RIB

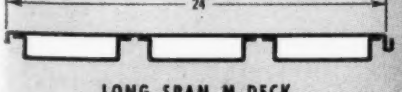
WIDE-FLANGE DOUBLE RIB



LONG SPAN M-DECK
SECTION M1-G



LONG SPAN M-DECK
SECTION M2-A



LONG SPAN M-DECK
SECTION M3-A

The illustration above shows Mahon Wide-flange Double Rib Steel Deck installed over bowstring trusses of a new roller skating rink. Year after year, Steel Deck roofs a greater percentage of new construction . . . and, it will continue to do so, because it weighs less and it costs less than any other type of permanent roof construction. Mahon Steel Deck is now available in the five Sections shown at left. The Long Span M-Deck Sections can be employed either with flat plate up or flat plate down . . . they span from beam to beam, eliminating roof purlins, and, when installed with flat plate up, they produce an attractive beamed ceiling effect. In either position, the bottom metal can be perforated and sound absorbing material inserted in the Cel-Beams to provide a highly effective acoustical ceiling. See Sweet's Files for information, or write for Mahon Catalogs D-56 and M-56.

THE R. C. MAHON COMPANY • Detroit 34, Michigan

SALES ENGINEERING OFFICES in NEW YORK and CHICAGO • Representatives in Principal Cities

Manufacturers of Steel Deck for Roofs, Partitions, and Permanent Floor Forms; Insulated Metal Walls and Wall Panels; M-Floors (Mahon Cel-Beam Floor Systems); Rolling Steel Doors, Grilles and Underwriters' Labeled Automatic Rolling Steel Fire Doors and Fire Shutters.

MAHON

DEPENDABLE, EFFICIENT JOHNSTON PUMPS *offer many advantages*

Look at This Compressor Station Job, for example...

These two Johnston Close-Coupled Pumps are recirculating 130°F. water through a cooling system at an Oklahoma Natural Gas Company pipeline compressor station. Installed in September, 1950, these units are 5 horsepower, single stage, 10 inch pumps with open line shaft and 5½ feet of 6 inch discharge column. Each unit delivers 600 gallons per minute against a head of 30 feet.

Engineers of Oklahoma Natural Gas Company wanted more than high efficiency out of the pumps for this job. They wanted pumps that would give no priming problems, that would be easiest to maintain and would require as little floor space as possible.

The Johnston Pump Dealer in Tulsa recommended the pumps that were finally selected for this job, because they met all the requirements BETTER than any other pump.

For complete information about Johnston Pumps and the name of your nearby Johnston Dealer, mail the coupon today.

JOHNSTON PUMP COMPANY

Bin "K"
Pasadena 15, California

☐ Please Send Bulletin CE-125

☐ Have Representative Call

Name_____

Address_____

City_____ Zone____ State_____

little faith in a soil study. . . .

It is refreshing to see in print the concept of Soil Mechanics as a science validated by one of the first large firms in this field. The article does an excellent job in pointing out that competent personnel are required in every phase of a soils study. There are a number of excellent firms and consultants throughout the country today, capable of providing competent soils engineering services. As long as a client selects a reputable firm, he can be assured that he is buying science, not sorcery.

R. H. Karol
Karol-Warner
Highland Park, N. J.

Practical Approach

Sir:

I have only recently read an article in your May issue by Dean Clement J. Freund of the University of Detroit: "A Practical Approach to Ethics."

It is obvious that Dean Freund is speaking for the minority of engineers who are engaged in the private practice of engineering, who are members of the teaching profession, or who are top level executives. His remarks are singularly lacking when applied to the vast majority of engineers who are "employees" in every sense of the word.

On April 29, 1954 I tendered my resignation to the American Society of Civil Engineers of which I was a Junior Member. I should like to quote from my letter to the Society.

"I feel that the Society has spent too much time on technical matters which for the most part are of academic interest only and has failed to accomplish much toward bettering the economic status of the civil engineer. At the same time the Society has lent credance to the popular notion that there is a shortage of engineers while publishing advertisements for positions open which pay a Ph. D. less in salary than the average fry cook."

. . . The engineering profession deserves to be frightened over the threat of unionization, however positive action on their part would nip the movement in the bud. The answer is very simple: the engineers through their professional societies must take steps to require that professional talent is paid a professional wage. . .

William H. Longeneck er, Jr.
Coachella, Calif.

high and mighty . . .

JEFFREY BUCKET ELEVATORS

Some are higher than a 25-story building. Some carry loads of as much as 900 TPH. *All* Jeffrey bucket elevators deliver the tireless performance at low operating cost demanded by modern materials handling.

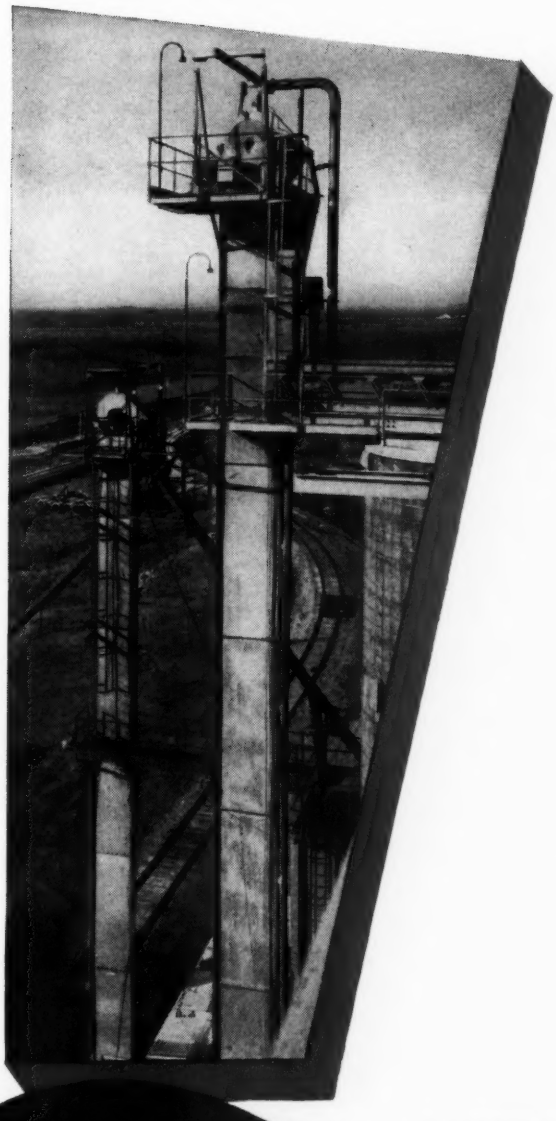
Whether your layout requires a tall elevator . . . a super-capacity elevator . . . or rugged, economical standard units for *any* bulk elevating job—Jeffrey designs them, builds them, backs them with a proud reputation.

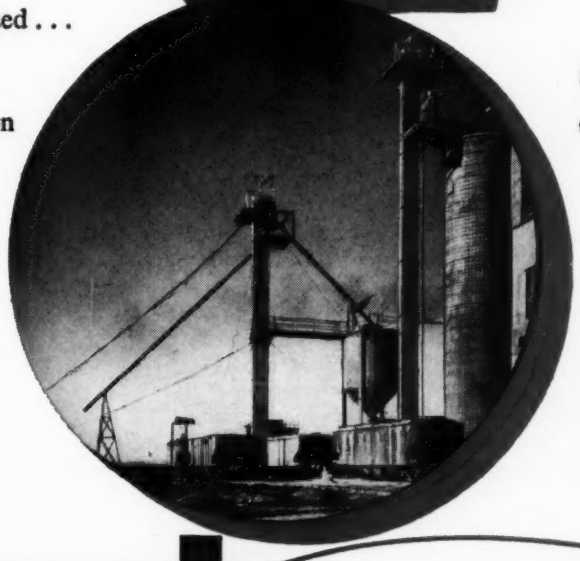
Jeffrey bucket elevators are giving unexcelled service in every industry requiring bulk handling of materials. Types include vertical or inclined . . . continuous, positive or centrifugal discharge . . . standard or super-capacity . . . open or enclosed . . . chain or belt . . . up to 300-ft. centers.

Whatever your elevator need, get a quotation from Jeffrey. You'll save money on initial costs as well as on maintenance.

JEFFREY ELEVATORS GIVE YOU THESE FEATURES:

1. Large inspection doors on both sides, easily removed for access to chain (or belt) and buckets.
2. Casings of heavy gauge steel in rigid angle construction.
3. Highest-quality chilled sprockets (cast iron or steel pulleys).
4. Removable hoods—either one-piece or split.
5. Dust-tight construction throughout.
6. Clean-out doors on both sides.
7. Self-aligning take-ups—sleeve or anti-friction types.





Jeffrey bucket elevators handling material to silo storage. Taller elevator feeds Jeffrey mechanical vibrating conveyor over silos.

WRITE FOR JEFFREY CATALOG NO. 850.

THE JEFFREY MANUFACTURING CO.

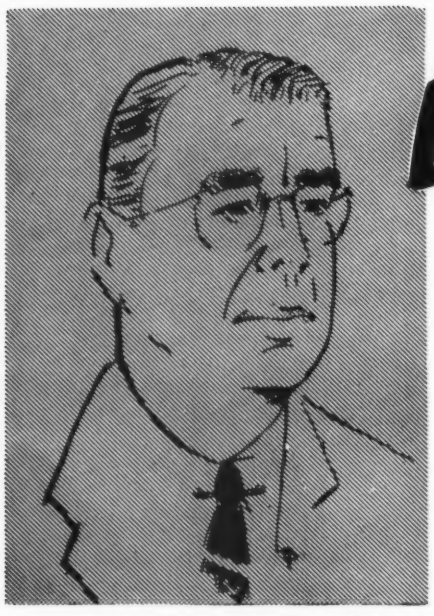
ESTABLISHED 1877

Columbus 16, Ohio

sales offices and distributors in principal cities

PLANTS IN CANADA, ENGLAND, SOUTH AFRICA.

IF IT'S MINED, PROCESSED OR MOVED . . . *IT'S A JOB FOR JEFFREY!*



ECONOMIC News Notes

E. F. Mac Donald
INDUSTRIAL ECONOMIST

BIGGER — Outlays for new construction in 1956 may reach the record-breaking total of $44 billion, according to a joint estimate of the Commerce and Labor Departments. This would be about 5% more than the 1955 total. The Government crystal ball showed "substantial gains" in store for private non-residential and public construction. A slight drop in new home building will be largely offset by increased outlays for additions and alterations. These estimates are based on the assumption of a slight increase in general economic activity and make allowance for continued moderate rise in construction costs.

AND BIGGER — Outlays for plant and equipment in 1956 will be a substantial 13% larger than in 1955. A nation-wide survey, conducted annually by McGraw-Hill Publishing Co., discloses plans of American industry to boost capital expenditures by the largest percentage increase in peacetime history. The strength of the boom is reflected in the expectations of a large number of reporting companies that their 1957 expansion programs will equal or exceed 1956 outlays. The survey shows manufacturing firms in the van of all business with a planned increase of 30%, with railroads following the lead closely with a 27% boost. Reduced capital spending in 1956 is currently planned by electric and gas utilities—10% less, and by the mining industry—a 15% drop. Spectacular plans are currently reported by iron and steel companies—78% increase, by nonferrous metals firms — 54%, and by the auto makers — 68%. Quite a showing by supposedly "mature" industries.

BATTER UP! — Anything that interferes with production pushes up costs, and the sport (says the Supreme Court) of baseball is no exception. Comes rain — before the bottom of the 5th inning — and the game stops and costs rise. It may be that developments in rigid structural plastics may do away with rain checks. Although the largest construction of this type so far falls far short of covering a baseball field, it is reported that domes 350 ft high and 600 ft across can be built, using metal ribs, to provide complete protection from weather interference.

DIXIE UPBEAT — A projection of industrial expansion in the Southeast to 1965 indicates that this 13-state region should have by that time about 30% of the nation's manufacturing plants. To achieve this goal, and it is expected it will be attained, Dr. F. J. Soday of Chemstrand told a recent meeting of the Southern Association of State Planning and Development Agencies that the region would have to build three plants a day for a total of 10,000 in the 10-year period.

COLOSSAL — Standard Oil of New Jersey has announced what will be largest single-year capital outlay ever made by a private business concern—$1.2 billion for capital projects in 1956. Major shares will go for refining facilities, for expansion and production of crude oil, and for transportation equipment.

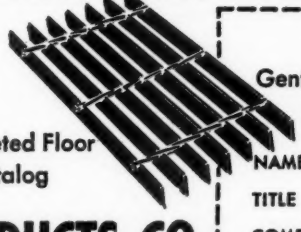
BASIC GROWTH — With iron and steel operations pressing steadily against capacity (note upward trend of production since Korean War in chart), the fourth quarter of 1955 has been marked by the roll-call of the industry announcing new and additional plans for capacity expansions: Armco—$111 million, Inland—$260 million, Jones & Laughlin—$115 million, National—$200 million, Republic—15% expansion, and Wheeling—$65 million. It is likely also that by the time this appears, Bethlehem and U.S. Steel will have announced new king-sized expansion plans. A recent study by the Iron & Steel Division of the Defense Services Administration concludes that the 126-million-ton capacity of the industry at the outset of 1955 will be boosted to 150 million tons by 1960.

PIG IRON AND STEEL PRODUCTION

Source: Board of Governors of the Federal Reserve System.

Q. Where can I find an inexpensive, light, fireproof, completely ventilated flooring?

A. BORDEN ALL/WELD floor grating in this installation furnishes all the above features—PLUS—it is self-cleaning and Borden All/Weld floor grating is solidly welded without cracks or crevices—to eliminate corrosion.



Write for complete information on BORDEN All/Weld, Pressure Locked, and Riveted Floor Gratings in this FREE 8-page catalog

BORDEN METAL PRODUCTS CO.

817 GREEN LANE ELizabeth 2-6410 ELIZABETH, N. J.

SOUTHERN PLANT—LEEDS, ALA. — MAIN PLANT—UNION, N. J.

BORDEN METAL PRODUCTS CO.

Gentlemen:

Please send me BORDEN Catalog

NAME .....

TITLE .....

COMPANY NAME .....

ST. AND NO. .....

CITY AND STATE .....

SCRAPS & SHAVINGS

CONSULTING ENGINEER MAGAZINE is, in a sense, in private practice. By that we mean that this publication is privately owned and operated and is in no way, officially, or unofficially, connected with any society or organization. We have no intention of ever changing that status. We make this declaration of independence because there seems to be the idea in some circles that we were back of the recent efforts of the State Associations of Consulting Engineers to form a National Association.

Actually, the credit for arranging that meeting in St. Louis, and for its accomplishments, must go entirely to such men as Joe Williamson, President of the Missouri Association of Consulting Engineers; C. C. Pate, President of the Consulting Engineers Association of Oklahoma; and T. E. Roche, of the Minnesota Association of Consulting Engineers. These men and their associates recognized the need for a National Association and instigated the movement that culminated in the meeting of ten State Associations, on October 28.

The fact that we cannot take credit for instigating the formation of a National Association of Consulting Engineers should not in any way imply that we look upon the organization with disfavor. Actually, after listening to all of the discussion, we left with the feeling that this meeting was a good thing and that the proposed Association, properly founded and administered, could do good for the profession.

A reading of the report on the meeting as published in this issue will indicate both the reasons for and the objections to the formation of a National Association. The reasons for such a group are to provide:

¶ A clearing house of information for the State Associations of consulting engineers.

¶ A concerted voice on a national level for engineers in private practice.

¶ A qualified staff to deal with general problems having to do with consulting engineers and their relations with clients, contractors, architects, manufacturers, and government agencies.

¶ A concerted voice raised against "free professional engineering," making use of all ethical media of publicity and advertising.

The principal objections to such a group are:

¶ The National Society of Professional Engineers is already filling or is ready to fill these needs, particularly through the new Functional Groups.

¶ The American Institute of Consulting Engineers could fill these needs through regional chapters.

¶ This new group would be "just another engineering organization"—one more step away from unity.

After hearing all of the discussions, we feel that while the arguments against are sound, they are not as strong as the arguments in favor of a National Association. For example, we do not think that NSPE, even through its newly conceived Functional Groups, can or should spend the time or the money the proposed program would require when only a small part of their members are consultants. While AICE might be a logical group to take on this program and operate nationally through state chapters, such an arrangement would mean that each state association would have to change its constitution and by-laws to match those of AICE, and many active members of the State Associations would not be qualified. The current feeling of the State Associations are that they do not want to join a group in which each State Association would have to conform to a common constitution.

While the formation of a National Association might be thought of as the beginning of another new engineering society, it might equally well be considered the gathering of ten or more independent associations under one head. That is, instead of increasing the number of engineering societies by one, this might be thought of as reducing the number by nine or more.

However, there is certainly no reason that a new National Association of Consulting Engineers, if formed, should in any way conflict with the activities of either NSPE or AICE. As now constituted, both of these groups could work in harmony with a National Association. It seems to us that the legitimate objectives of a National Association of Consulting Engineers would be additive and in no way opposed to the objectives of NSPE, AICE, or EJC. (The College of Surgeons works with, not against, the American Medical Association.)

We approve, in other words, the objectives of the proposed Association. We also are in favor of and will support all activities of any group, NSPE, AICE, and EJC, that we feel are designed to promote the interests of the consulting engineer.

the Legal Aspect

MELVIN NORD
Consultant in Legal and Technical Problems
Registered Professional Engineer
Patent Attorney

Air and Water Pollution: The Nuisance Doctrine

AIR AND WATER POLLUTION are in many respects merely different aspects of the same problem, since they are closely related both factually and legally. They are related factually in the following ways: (1) They relate to changes in the concentration of contaminants in the principal environmental reservoirs or "sinks" of mankind, i.e. the air and the waters of the earth; (2) In many instances a particular contaminant may be emitted at will either into the air or into water, i.e. gases or gas-borne particles may be scrubbed with water, thereby becoming water pollutants, — or polluted waters may be evaporated and residues burned, thereby becoming air pollutants. It frequently happens that a water-borne pollutant simultaneously causes air pollution through the odor it emits.

As a result of these factual similarities, it also develops that air and water pollution are closely related legally. In this and the next few columns, these legal similarities, as well as the legal differences, will be illustrated.

The principal legal similarity between air and water pollution is based on the common law doctrine of nuisance, and it is this doctrine that we shall study in this column.

Definition of Nuisance

Although there is perhaps no more impenetrable jungle in the entire law than that which surrounds the word "nuisance," according to a well-known legal authority, the following is an adequate definition: "The nuisance doctrine operates as a restriction on the right of an owner of property to make such use of it as he pleases. The term "nuisance" is applied to that class of wrongs that arise from the unreasonable use by a person of his own property, which produces material annoyance, inconvenience, discomfort, or hurt to others." If the wrong is to other individual persons, i.e. if it amounts to an unreasonable interference with the use or enjoyment of their property, it is a civil wrong or tort, and is called a private nuisance. If it is to the public at large, it is a misdemeanor or minor crime, and is called a public nuisance. In many cases, but not in all cases, an activity may constitute both a public nuisance and a private nuisance.

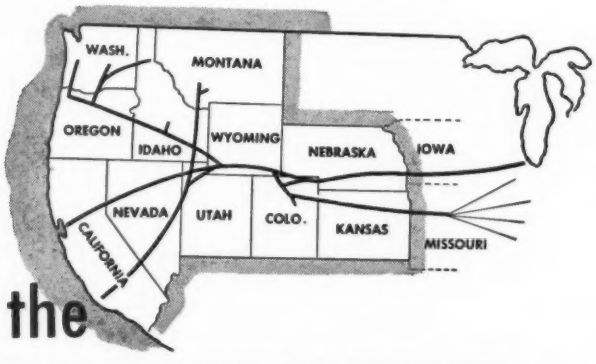
What Is Reasonable?

The difficulty with the definition of nuisance resides in the word "unreasonable." There are no logical or legal rules from which one can determine absolutely whether or not a particular activity is reasonable or unreasonable. What is reasonable to the factory owner may be unreasonable to the neighboring property owner. The decision as to who is right is thus a question for the courts to decide. In many cases one cannot tell for certain whether or not a nuisance is being committed without going through an involved, lengthy court case. However, in many other cases, it is obvious that a nuisance is being committed, and in such cases the person or company committing the nuisance would be well advised to stop it before the law does it for him.

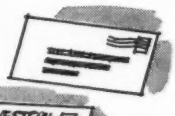
In order to predict with any reasonable assurance what a court may do in a nuisance case, we must study the experimental data available. This consists primarily of records of previous court decisions in similar cases. On the basis of such an analysis, we can at least classify certain fact situations as definitely inside or definitely outside the category of nuisance, while still leaving enough borderline cases to keep the lawyers happy.

The first defense generally attempted in nuisance cases is that there is no intention to injure and no negligence. This defense suffers from the defect of being no defense at all. Liability for nuisance is not predicated on either negligence or intention to injure; it is based on strict liability. The only test in such cases is whether a wrong has been committed, not why it was committed. In pollution cases, negli-

for information
about favorable
INDUSTRIAL SITES



in the
UNION PACIFIC WEST

get in touch
with your nearest
"**U.P.**" representative
or write  .. or
wire

UNION PACIFIC RAILROAD

Industrial Development Dept.
OMAHA 2, NEBR.

In the eleven-state territory which it serves, Union Pacific provides the finest in rail service. In many cases, industrial trackage can be built where requested.

UNION PACIFIC RAILROAD

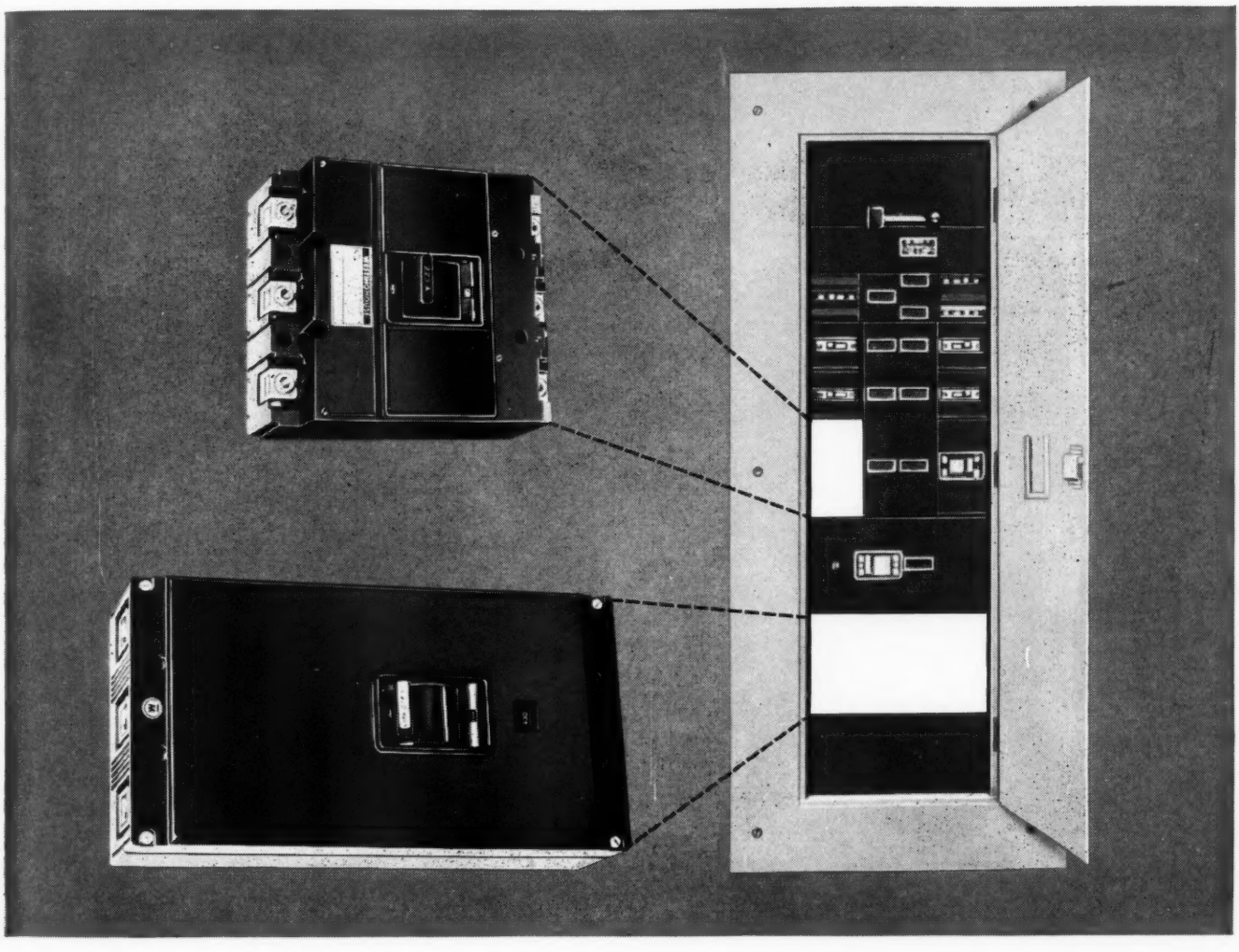
gence can generally be shown, but it is not necessary to do so. The liability exists regardless of this. (However, absence of negligence or of intention to injure may have some effect on the amount of damages given, and on the decision as to whether or not the activity should be enjoined.)

Other Offenders

Another defense frequently offered is that others are doing the same thing. The easy answer to this is that two wrongs do not make a right. The mere fact that others are committing nuisances is no excuse for the defendant to do the same thing. In other words, if it is established that the defendant is committing a nuisance, he is liable regardless of the fact that others are doing the same thing. However, it is within the realm of possibilities that the activities of others may be such as to take the defendant's activities outside the category of a nuisance. Thus, a steel mill may constitute a nuisance in a residential district, while it may not be a nuisance in some other locality. This is because what is reasonable is a relative term. It is not reasonable to discharge impure water to a reservoir that is to be used for drinking purposes, but if the body of water has a higher concentration of the contaminant than the effluent being discharged into it, the activity may very well be reasonable; in fact it may be purifying the stream instead of polluting it. And it has been held many times that a resident of a heavily industrialized area cannot reasonably expect country-fresh air. Thus, an activity may conceivably be reasonable in view of what others are doing. But if it is an unreasonable activity, it makes no difference what others are doing.

Another defense that is sometimes offered is that "it won't happen again." The answer to this is that an act need not be continuing or periodic in order to constitute a nuisance. However, if it is only a single act that is being com-

—Continued on page 28



New Circuit Breaker Developments Provide Panelboard Economy and Spacesaving

Outstanding new developments in circuit breaker design have made possible increased economy, spacesaving, and protection in Westinghouse circuit breaker distribution panelboards.

Westinghouse panelboards incorporate the new type J and KL De-ion® circuit breakers that provide increased interrupted capacity, previously available only in larger breakers.

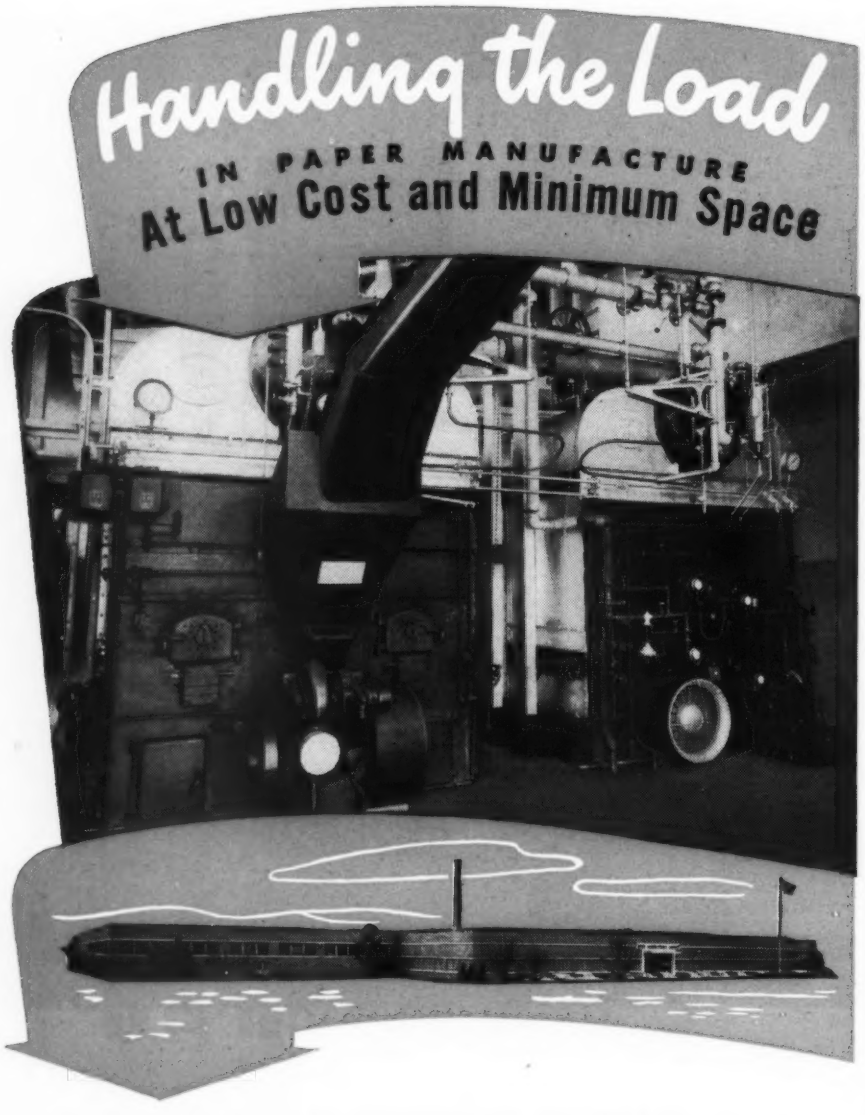
The J frame breaker now has interrupting capacity of up to 25,000 amperes and the KL frame breaker up to 40,000 amperes at 240 volts, a-c.

The Westinghouse distribution panelboard with its "screwdriver flexibility" incorporates these new breakers without panelboard design change.

What is more, the existing Westinghouse panelboards that require additional circuit protection or expansion can utilize the new breakers. For example, an existing K frame breaker may be removed and two J frame breakers put in its place—thereby increasing capacity and maintaining maximum protection.

Why don't you call on your Westinghouse Panelboard Engineer to help you with the application of these new developments? DP-5021-E

YOU CAN BE SURE...IF IT'S Westinghouse



TITUSVILLE TICOTHERM
STEAM GENERATORS

For Paper Manufacturers Company, at their Bustleton, Pa. plant, two main types of firing are handled efficiently by these Titusville TICOTHERM Steam Generators. No. 1 boiler has a ram-type underfeed stoker, No. 2 is equipped with oil burner for standby, providing flexibility for all processing and heating needs of the large plant pictured.

Write for your copy of informative Ticotherm Bulletin B-3250A —sent promptly on request.

THE TITUSVILLE IRON WORKS COMPANY
TITUSVILLE, PA.

A division of Struthers Wells

Manufacturers of A Complete Line of Boilers for Every Heating and Power Requirement

plained of, an injunction will not be granted, and the plaintiff will be limited to recovery of damages.

Types of Nuisance

It is also frequently claimed that a certain activity is not a nuisance because it is not a menace to health. This is best answered with a "So what?" It is not necessary that there be any health menace in order for an activity to constitute a nuisance. Economic injury, or any substantial interference with another's use or enjoyment of his property or his other rights is sufficient to constitute a nuisance. Mere offenses to the senses can be nuisances. However an activity is not a nuisance merely because it offends the aesthetic sense. And mere apprehension that something will become harmful will not generally be sufficient.

The amount of interference with the plaintiff's interests must be substantial and not trivial, since the law does not concern itself with trifles. If the injury is such that normal persons would not be affected, hypersensitive individuals will get no legal relief. But just because some persons are hardened to a particular discomfort, this does not prevent a normal person from obtaining legal relief.

It is frequently argued that a certain business is not a nuisance because it was started in a rural area that has subsequently become residential. While this may be an important factor in some injunction cases it does not necessarily prevent an activity from being a nuisance for which legal liability in damages may be incurred. This problem, as well as the question of whether the value of the business can be taken into consideration, will be considered subsequently when we discuss the factors involved in obtaining injunctions in nuisance cases.

Remedies Available

For the present, we shall conclude by listing the types of remedy available in nuisance cases. There are, in the absence of

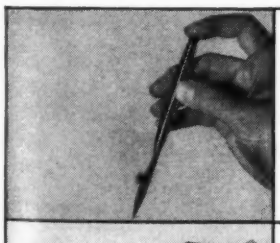
FROM BRUNING—

Your Largest Supplier of Quality Engineering and Drafting Equipment...

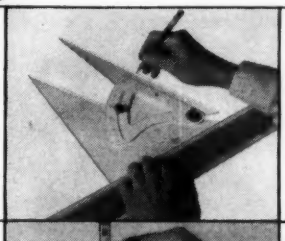
5 Wonderful, Low-Cost, Time-and-Work Savers!

Little things mean a lot in drafting! That's why the five outstanding, low-cost drafting aids featured here are important to you. That's why they and many products like them are important members of Bruning's complete quality line. Try them; you'll be mighty pleased at how fast the savings of time and labor mount up.

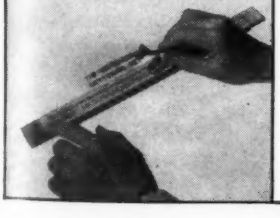
Bruning Electric Erasing Machine
Save hours of finger-cramping manual erasing. Do a neater, safer erasing job. The patented hollow shaft permits use of extra-long, seven-inch eraser, prevents "fly-outs." These quiet, cool, vibration-free tools are permanently lubricated, require no maintenance.



"Rule-O-Matic" Ruling Pen
Eliminate the fuss, muss, and time of filling pens from bottled ink. Just a press of the finger, and a drop of ink flows from the cartridge in the hollow handle into the stainless steel nibs. A single catridge can rule up to 55,000 inches of a government approved India ink. Life-time guarantee.



Adjustable Triangle
Think of the time and work you'll save with this versatile drafting tool. It is fully adjustable from 45° to 90°. Reads to one-half degree. The engine divided protractor arc is beveled for quick, easy, precise settings. It is precision made of acrylic plastic for permanent clarity, long wear.



Wrico "Zephyr" Lettering Set
Now, get the work-saving advantages of a modern *scriber-type* lettering set ... for less than ten dollars! Unique skid-proof runners keep the guide holder securely in position for perfect lettering. Three popular sizes of letters and numbers provide a versatile lettering combination.

"Tru Point" Pencil Lead Pointer
Save time and trouble with the most efficient and economical pencil pointer ever devised. You get a perfect concentric point to any degree of sharpness, and without breakage of lead in the pointer. Extra weight keeps pointer steady, lets you do pointing with one hand.

Take a minute now to mail the coupon. Save yourself hours of time and work later on.

BRUNING

America's Largest Supplier of Engineering and Drafting Equipment.

CHARLES BRUNING COMPANY, INC., 4700 MONTROSE AVE., CHICAGO 41, ILL.
Charles Bruning Company (Canada) Ltd., 105 Church St., Toronto 1, Canada

Charles Bruning Company, Inc., Dept. 124-K
4700 Montrose Ave., Chicago 41, Illinois
Please send me information on these Time-and-Work Savers:

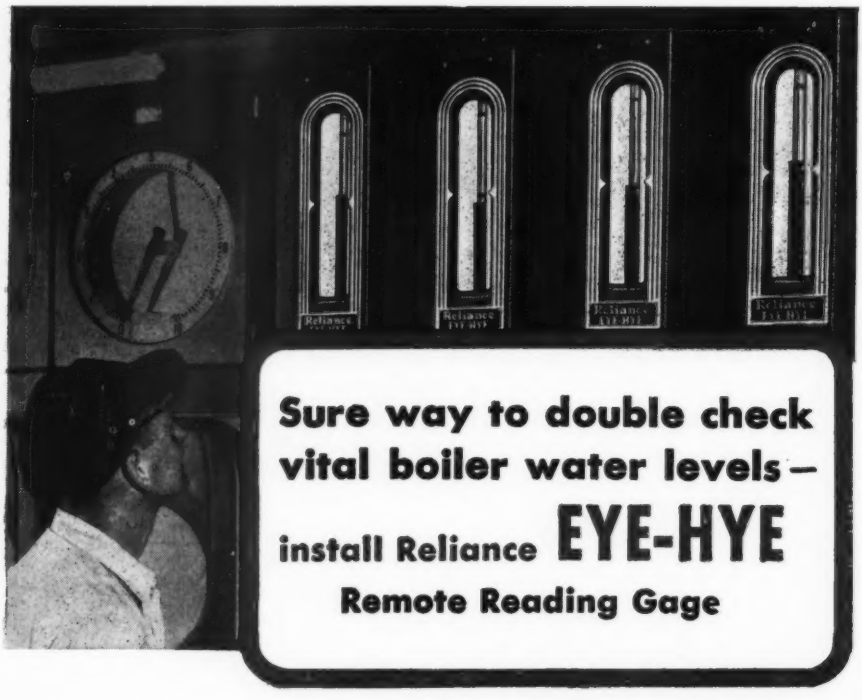
☐ Electric Erasing Machine ☐ "Rule-O-Matic" Pen ☐ "Tru Point" Pencil Pointer ☐ Adjustable Triangle ☐ Wrico Lettering Set

Name_____ Title_____

Company_____

Address_____

City_____ County_____ State_____



Sure way to double check vital boiler water levels — install Reliance EYE-HYE Remote Reading Gage

It's fine to have automatic controls, but be sure you have the important safeguards against possible failure — adequate *maintenance* and *cross-checks.*

EYE-HYE is your reliable cross-check for *boiler water levels.* A manometric-type remote reading gage, it keeps operators informed on water level status. Easier to read than conventional gages, although it's the same familiar form — a vertical column of liquid. EYE-HYE's indicating fluid is a pleasing green that "pops out", brightly illuminated from the rear.

You can place EYE-HYE any reasonable distance from the drum — above or below it, on wall or instrument panel. Easy to install and maintain — no mechanical working parts — no adjustments on location. Write for Bulletin CO and learn how EYE-HYE can increase the efficiency of *all* your water levels.

How one user checks water levels in surge tank and feed water heater with long type EYE-HYEs. (Face plate can be calibrated at factory.)

The Reliance Gauge Column Company
5902 Carnegie Avenue • Cleveland 3, Ohio

a statute or ordinance, three possibilities: an action in equity for an injunction, an action at law for damages, and self-help. Self-help is justified only when an irreparable injury is being or is about to be repeated and there is insufficient time to wait for legal relief. The privilege of using self-help is restricted to the use of reasonable force in a reasonable manner, and within a reasonable time after knowledge of the nuisance is acquired. One who uses such a remedy takes a chance. The honest belief that he is right will not prevent criminal prosecution against him or the attaching of civil liability. No special rules of law are involved in suits at law for damages, but equity suits for injunction require further discussion, which will be given in the next column in this series, with typical court cases involving air pollution. ▲▲

ARTICLE REPRINTS

A limited number of reprints listed below are available free of charge to our readers. If you need an extra copy please write, using your company letterhead, to: Reader Service Dept., CONSULTING ENGINEER, 227 Wayne St., St. Joseph, Mich.

"Permanent Magnets . . . history and theory"
"Profiling the Earth From the Air"
"More Than One Way to Skin a Building"
"Ethical Practices"
"Make Safety an Integral Part of Design"
"Pipeline Network Computors"
"A Practical Approach to Ethics"
"What To Do When Your Clients Need Air Pollution Control"
"What It Takes To Consult In Automation"
"Electric Spark Machining"
"Design Data For Expansion Joints"
"Engineering A Site Study"
"What's New in Blasting?"
"Profitability Calculations Simplified"
"Gage Glass to TV Tube"
"Lift Slab Construction"
"Selecting Automatic Controls for Water Conditioning Equipment"
"High Temperature Water and its Applications"

91% are p-k equipped*

* Yes, 91% of New York skyscrapers use p-k heat exchange equipment—instantaneous hot water heaters, storage water heaters, preheaters, condensate coolers, converters, freon coolers, etc. You get the finest when you specify p-k.

the **Patterson-Kelley Co.,** inc.

East Stroudsburg, Penn.

101 Park Avenue, New York 17 • Railway Exchange Building, Chicago 4 • 1700 Walnut Street, Philadelphia 3 • 96-A Huntington Avenue, Boston 16 • and other principal cities

ATOMS IN ACTION

OBSTACLES to harnessing the fusion reaction for peace (or any other purpose) were summed up by Atomic Energy Commissioner Henry DeWolf Smyth before the National Industrial Conference Board. "If the thermonuclear reaction is achieved, if the reacting gas can be confined, if the energy can be recovered, if the energy balance is favorable, there still remains the question of how much the energy will cost."

PROSPECTS of some kind of an International Atomic Energy Agency seemed good at the end of October with the unanimous resolution of the Political & Security Committee of the U.N. recommending that the 12 negotiating nations (Australia, Belgium, Canada, France, Great Britain, Portugal, South Africa, Brazil, Czechoslovakia, India, the U.S.S.R., and the U.S.) "take all possible measures to establish the Agency without delay." The Russians have tentatively approved the draft statute, final approval hinging on adoption of their proposed amendments.

FOUR UTILITIES, Central Power Electric Coop., Minnkota Power Coop., Northern States Power, and Otter Tail Power, have established a $100,000 grant at the University of Minnesota Institute of Agriculture for a study of how atomic energy can aid agriculture.

NEED FOR THE DEVELOPMENT of national standards and codes in the field of nuclear energy will be discussed at a general conference to be held by American Standards Association, December 8, at the Hotel Statler, in Washington, D. C. The meeting is an outgrowth of

HANDLE COAL AUTOMATICALLY!

"TAKE IT UP A FLO→TUBE"®

CANTON STOKERS

The spiral conveyor of steady, dependable service. Sturdy cast iron trough bolts together in 3 ft. sections, capped with steel plates for easy removal if ever necessary. Built to take the abuse of coal, yet with tolerances just right to handle materials from grain size to lump.

To fill 3 or more hoppers use gate-valves in Flo-Tube horizontally. Below, filling 2 hoppers with "Y" chute.

Hopper level maintained by 'off-on' automatic switches.

Exposed end for pick-up

CANTON STOKER CORP.

SPECIALISTS IN AUTOMATIC COAL FIRING, HANDLING AND CONTROL EQUIPMENT

425 ANDREW PLACE S. W. • CANTON, OHIO

HERE'S A PARTIAL LIST OF FLO-TUBE INSTALLATIONS . . . YOU MAY WISH TO VISIT AND INSPECT ONE NEAR YOU—

	NO. IN SERVICE
HIGH SCHOOLS, COLLEGES:	
Hereford Jr.-Sr. High School, Hereford, Maryland	2
North High School, Akron, Ohio	2
St. Mary's Czest School, Milwaukee, Wisconsin	1
Robert A. Taft High School, Cincinnati, Ohio	2
Sacred Heart Seminary, Detroit, Michigan	1
Frostburg State Teachers College, Frostburg, Maryland	1
Sisters of Good Shepherd, Indianapolis, Indiana	1
Hillsboro High School, Hillsboro, Missouri	2
Ambridge High School, Ambridge, Pennsylvania	1
School No. 215, Baltimore, Maryland	2
HOSPITALS:	
Charleroi-Monessen Hospital, N. Charleroi, Pennsylvania	1
St. Elizabeht's Hospital, Youngstown, Ohio	1
Miners Hospital, Frostburg, Maryland	2
APARTMENTS, BUILDINGS:	
Laird Building, Tiffin, Ohio	1
Montgomery Gardens Apartments, Jersey City, New Jersey	2
Russell Lamson Hotel, Waterloo, Iowa	1
INDUSTRIAL PLANTS:	
Sugardale Provision Company, Canton, Ohio	1
Cincinnati Shaper Company, Cincinnati, Ohio	2
Cooper Tire & Rubber Company, Findlay, Ohio	1
Beckett Bronze Company, Muncie, Indiana	1
A. Gross & Son, Newark, New Jersey	1
Milwaukee Asphalt Plant, Milwaukee, Wisconsin	2
GREENHOUSES:	
E. A. Dreger Greenhouse, Cleveland, Ohio	1
M. F. Cutting & Sons Greenhouse, Cleveland, Ohio	1
Thomas F. Browne Greenhouse, Detroit, Michigan	2
Boyert Bros. Greenhouse, Cleveland, Ohio	1
Ray Fitkin Bros., Sylvania, Ohio	1
Jensen's Greenhouse, Warren, Ohio	1
Dulabahn's Florists, Canton, Ohio	1
Berea Greenhouse Company, Berea, Ohio	2
Patterson Flowers, Shelby, North Carolina	1
United Greenhouse Company, Cleveland, Ohio	3
A. C. Radke Greenhouse, Cleveland, Ohio	1
Bunker Hill Greenhouse, Medina, Ohio	1
DAIRIES, BREWERIES:	
Miller Dairy Farms, Eaton Rapids, Michigan	1
United Dairy Company, Lodi, Ohio	1
Lake to Lake Dairy Corp., Kiel, Wisconsin	1
Schoenling Brewery, Cincinnati, Ohio	1

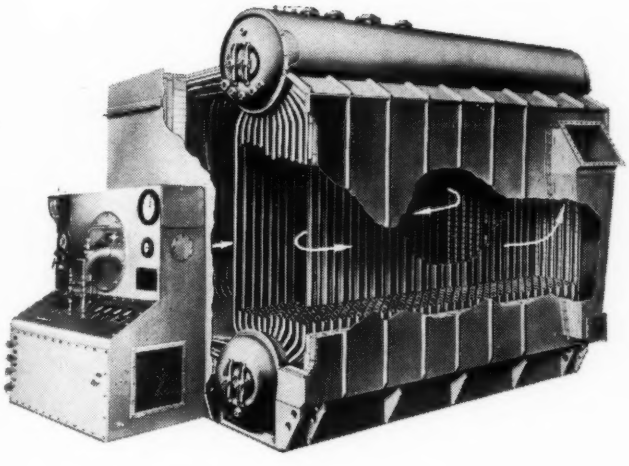
FOR STEAM CAPACITY up to 60,000 POUNDS

Choose your boiler from these two

If you burn oil or gas, investigate the VP Package Boiler for capacities up to 40,000 pounds per hr . . . the VU-10 up to 60,000 pounds.

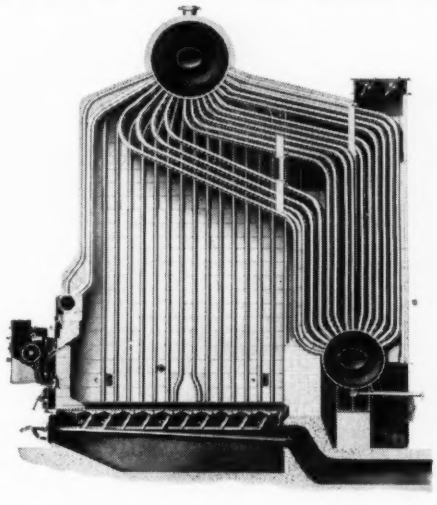
For stoker firing, the VU-10 is available from 10,000 to 60,000 pounds of steam per hour.

Whatever your fuel . . . whatever your steam capacity requirements up to 60,000 pounds per hour . . . you'll find that one of the Combustion Engineering Boilers described below will be just right for you.



The VP boiler

The C-E Package Boiler, Type VP . . . is completely shop-assembled . . . for oil or gas firing. It is available in capacities from 4,000 to 40,000 lb steam per hr; for pressures to 500 psi. The VP Boiler has more water-cooled area per cubic foot of furnace volume than any other boiler of its size and type. The large (30-in. diameter) lower drum permits a simple, symmetrical tube arrangement . . . greater water storage capacity . . . easy access for washing down or inspection. A low-speed, centrifugal fan, which is exceptionally quiet in operation, is standard equipment. Baffle arrangement is simple, resulting in low draft loss . . . simple soot blowing . . . high heat absorption. The unit is pressure fired . . . has welded, gastight, steel casing . . . requires no induced-draft fan.



The VU-10 boiler

The VU-10 Boiler is designed for industrial load conditions, particularly for plants with small operating and maintenance forces. Capacities range from 10,000 to 60,000 lb steam per hr . . . pressure to 475 psi . . . heat recovery equipment is available if desired. Fuel can be either coal (C-E Spreader, Traveling Grate or Underfeed Stoker), oil or gas. This boiler is a completely standardized design adaptable to many conditions. It responds readily to variations in load; is simple to operate and maintain. All parts are easily accessible for inspection. Like the VP, the VU-10 Boiler is a complete unit — boiler, furnace setting, fuel-burning equipment, controls, forced draft — bringing you the benefit of one contract . . . one responsibility.

Fully descriptive catalogs are available on both of these boilers. We'll be happy to send yours upon request.

COMBUSTION ENGINEERING

Combustion Engineering Building • 200 Madison Avenue, New York 16, N. Y.

Canada: Combustion Engineering-Superheater Ltd.

B-858A

STEAM GENERATING UNITS; NUCLEAR REACTORS; PAPER MILL EQUIPMENT; PULVERIZERS; FLASH DRYING SYSTEMS; PRESSURE VESSELS; DOMESTIC WATER HEATERS; SOIL PIPE

Need Convertors?

With this bulletin
it's EASY to select the size you want

Here's a reference book specially arranged to help you select and specify Convertors. Right at your finger tips it provides complete information . . . including installation data . . . on our extensive line of Convertors. The tables are new and different. They have been carefully developed for your convenience in determining the right unit quickly. Be sure to get your copy of Bulletin 62 and keep it at hand for reference. Fill in the coupon and mail it today.

The Whitlock Manufacturing Co.
96 South St., West Hartford 10, Connecticut
In Canada: Darling Brothers, Ltd., Montreal

Whitlock

WHITLOCK Designs and builds: bends, coils, condensers, coolers, heat exchangers, heaters, piping, pressure vessels, receivers, reboilers.

The Whitlock Manufacturing Company
West Hartford 10, Conn.

Send me Bulletin No. 62 describing Whitlock Convertors.

Your name.....*Title*.....

Company name .....

Address .....

.....

requests by the Atomic Industrial Forum, the American Institute of Chemical Engineers, the American Society of Mechanical Engineers, and the National Electrical Manufacturers Association.

JUST ONE YEAR after announcement of a $67 million expansion of its own nuclear feed materials production and processing plants, the Atomic Energy Commission is inviting proposals by industry to "process, over a five-year period, uranium ores or concentrates to either uranium tetrafluoride or uranium hexafluoride, with deliveries to begin about July 1958." Since AEC's expansion program is to be finished by 1957, it would seem that they expect a large upswing in demand by 1958.

CONSUMERS PUBLIC POWER District of Columbus, Nebraska has received AEC approval of its revised proposal to build a 75,000 kw reactor of the sodium graphite type. The revised proposal calls for AEC to pay a fixed amount toward the reactor plant cost and to retain title to portions so financed. Yankee Atomic Electric Co. has also submitted a revised proposal but this one is still under consideration by AEC.

METALLURGICAL PROBLEMS that hinder development of atomic energy were pointed out by Rear Adm. H. G. Rickover, chief of AEC's Naval Reactors Branch, before an American Society for Metals audience: aluminum alloys exhibit excessive corrosion at power reactor temperatures (Alcoa is presently spending its own money in cooperation with AEC laboratories to find new alloys); stainless steel presents welding difficulties and it is difficult to obtain sound castings consistently. He also stressed the importance of a large-scale program to learn the mechanism of corrosion. But the biggest problem is still development of suitable reactor fuel elements.

SINCLAIR RESEARCH LABORATORIES plan to build a "hot laboratory" at their research laboratories in Harvey, Illinois. Radiation source will be spent fuel elements from MTR. Availability of fission products from future commercial nuclear power plants also influenced choice of radiation source.

THE EVALUATION STUDY of the Liquid Metal Fuel Reactor concept for AEC, recently completed by Babcock & Wilcox Co., has shown the design to be feasible. AEC is now asking groups interested in taking part in developing a small experimental LMFR to contact the Reactor Development Division of AEC.

THE COST-PLUS-FIXED-FEE contract for construction of AEC's $15 million engineering test reactor has been awarded to Kaiser Engineers Division, of the Henry J. Kaiser Co. The architect-engineering contract went to Kaiser in June. General Electric will design the reactor core under subcontract to Kaiser.

MONSANTO Chemical Company has confirmed reports that it is shifting emphasis from reactors to chemical applications of nuclear radiation. The Yankee Atomic Power Co. proposal for a dual-purpose (plutonium-plus-power) reactor, rejected by AEC, was drawn up with the help of Monsanto, killing any hopes Monsanto still harbored that AEC might ultimately accept the dual-power approach. It was this type of reactor that the company had put its time and money into developing.

this is "life insurance" for boilers

It's a good "policy" to protect your valuable boilers with YARWAY Boiler Level Indicators.

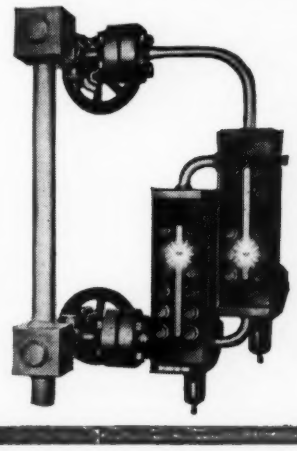
Instant . . . accurate . . . continuous remote readings of boiler water levels are available on the instrument panel or wherever you wish in the plant.

YARWAY's new "wide vision" face gives brilliant readings from any angle . . . and the pointer is always visible, even at extreme high and low water levels.

For brilliant "shines like a star" readings on the boiler drum you'll want to use YARWAY Flat Glass Gages with Type "M" Illuminators.

From drum to panel and at all remote locations, YARWAY equipment gives you the safest boiler protection you can buy—proved beyond doubt in nearly 10,000 installations.

◀ Yarway Remote Liquid Level Indicator. Write for Yarway Bulletin WG-1824.



Yarway Flat Glass Water Gage with Type "M" Illuminators. Write for Yarway Bulletin WG-1812. ▶

YARNALL-WARING COMPANY
106 Mermaid Avenue, Philadelphia 18, Pa.
BRANCH OFFICES IN PRINCIPAL CITIES

YARWAY **steam plant equipment**

WARNING SIGNS AND FENCE KEEP UNAUTHORIZED PERSONS AWAY FROM RADIOACTIVE BURIAL GROUNDS IN IDAHO.

Disposal of Radioactive Waste

Part 1 . . . The U. S. Approach

BERNARD MANOWITZ
Brookhaven National Laboratory

Ce exclusive

ONE OF THE BIGGEST headaches in the development of the atomic energy business is the disposal of radioactive wastes. In order to appreciate the problem in its proper perspective, it is necessary to review the atomic energy program from the point of view of radioactive waste disposal.

Here in the United States, in 1955, we are passing through Phase One of the reactor business, the operation of research reactors and the operation of plutonium production reactors; we are beginning to enter Phase Two, the operation of military propulsion reactors and the operation of power reactors.

During Phase One, both in research reactors and in production reactors, we have been burning solid fuel elements of either normal or enriched uranium. Thus far it has been necessary to reprocess fuel in order to recover valuable fissionable or fissile material. Now that we are entering Phase Two, several other possibilities present themselves. It is possible that fuel elements will be developed for military reactors and power reactors that can be burned to the point where it is not economically justifiable to recover fissionable materials. Obviously, this depends upon the value of those materials. Such a procedure would provide an optimum solution to the waste disposal problem. The fission products would still be locked in the fuel element, simple disposal techniques could be employed, and, in fact, spent fuel elements would probably provide secondary uses as radiation sources.

A second and more likely possibility is that fuel from military and power reactors will have to be reprocessed, resulting in the dilution and dispersal of the fission products into many media.

A third possibility is that homogeneous reactors, such as the ORNL aqueous reactor, or the BNL liquid metal reactor, will be used for power and propulsion. It is possible to go to high burn-ups with these types of reactors. It is also possible to continuously reprocess the fuel from them. In general, they will give off highly concentrated wastes.

Separation Plants

Plants for the separation of fissionable and fissile materials from spent fuel are located at four major sites: AEC's Hanford, Savannah River, Idaho, and Oak Ridge. Fuel from Phase One is now being reprocessed in these plants. Several possibilities exist as to what may occur to fuel from Phase Two. Fuel from military and power reactors may continue to be reprocessed in these government-owned plants. Or industry might build separation plants that will compete with government plants. As a third alternative, each power plant might build its own separation plant. Economic factors will probably deter-

mine which of these three paths industry will follow.

The cost picture, unfortunately, is clouded by several political questions. For instance, assuming government reprocesses fuel for industry, how much will it charge? Will all costs be recovered or will there be a subsidy? If all costs are recovered, how will present plants be amortized? These questions must be answered before industry can decide whether or not it can venture into the separation plant business. Assuming these questions are resolved, a detailed study will have to be made of the relationship between the cost of shipping fuel elements, distributing electricity, and disposing of wastes before a decision can be made as to the need and location of future separation plants.

Magnitude of the Job

Once the fission products are unlocked from the fuel element, as they are in any fuel recovery process, they may contaminate gases, liquids, and solids. Physically, not much mass is involved in the fission products themselves. One gram of fission products is produced in one megawatt-day. Chemically, about twenty elements are formed that range throughout the middle portion of the periodic table. Radiation characteristics of the significant fission products are indicated in Table 1.

For any specific site, the difficulty of the task of waste disposal will depend not only on the amount of radioactivity generated but also on the amount of radioactivity that can be discharged to the local environment. No federal or state regulations now exist governing the fission products that may be released from a separation plant. The development of such legislation must be carefully watched by industries interested in separation plants, since the permissible level of discharge will determine the complexity and cost of the waste disposal system. Thus far, discharge levels have been set by agreement with the AEC. Using these levels as a guide, it probably will be permissible to discharge no more than one curie per year of mixed fission products to the environment in populated areas. These requirements might be relaxed somewhat in unpopulated areas, and if ocean disposal can be employed, increased to perhaps 100-1000 curies per year.

One possibility that would permit the discharge of larger amounts of radioactivity would be the development of techniques for removing the long-lived fission products from the mixture. This would mean that the remaining fission products would have decayed to safe levels in approximately 10 years' time, rather than the centuries it would take if all of the long-lived elements were left in the mixture. The disposal of large amounts of the relatively short-lived residue, then, could be made where containments for periods of ten or twenty years could be assured. Deep wells extending to suitable water-bearing strata might be adequate for such disposal.

To get some idea of the magnitude of the waste disposal problem, let us take the example of a reactor generating 1000 megawatts of heat power. The equilibrium curie level in such a reactor would be about 10^{10}. Assume the reactor core has been discharged and permitted to cool and decay by a factor of 100. Then 10^8 curies must be processed, and no more than 1 curie of that 10^8 can be lost to the surrounding environment.

Consider the waste disposal problems in connection with this core at a hypothetical future separation plant. The first thing that will happen to the fuel sent to such a plant will be that its cladding will be removed. This may be done mechanically or chemically, resulting in either a solid or liquid low-level waste. Next, the fuel itself must be put into solution. This can involve some hazardous chemicals, depending upon the nature of the fuel. As long as the fuel is composed of uranium metal, it can be dissolved in nitric acid. However, enriched fuels in alloy form require solvents that will dissolve the alloys—for instance, hydrofluoric acid may be re-

TABLE I-CHARACTERISTICS OF SIGNIFICANT FISSION PRODUCTS

Isotope	Symbol	Yield	Half-Life	Radiation: Beta Energy-Mev	Radiation: Gamma Energy-Mev
Strontium 90	Sr	5.3%	25 years	0.61	None
→ Yttrium 90	Y		62 hours	2.3	None
Yttrium 91	Y	5.4%	57 days	1.53	None
Zirconium 95	Zr	6.4%	65 days	0.39 (98%) 1.0 (2%)	0.73 (93%) 0.23 (93%) 0.92 (7%)
→ Columbium 95	Cb		35 days	0.15	0.76
Technetium 99	Tc	6.2%	1×10^5 years	0.3	None
Ruthenium 106	Ru	0.5%	1 year	.03	None
→ Rhodium 106	Rh		30 seconds	3.5 (82%) 2.3 (18%)	0.51 (17%) 0.73 (17%) 1.2 (1%)
Cesium 137	Cs	6.2%	33 years	0.5 (95%) 1.19 (5%)	None
→ Barium 137	Ba		2.6 minutes	None	0.66
Cerium 144	Ce	5.3%	290 days	0.35	None
→ Praseodymium 144	Pr		17.5 minutes	3.0	0.2 1.2
Promethium 147	Pm	2.6%	4.4 years	0.22	None

TABLE 2-COSTS OF VARIOUS DISPOSAL PROCESSES

	Range of Solid Content in Feed	Variation of Concentration Factor with Solids	Decontamination Factor	Approx. Cost $/1000 gal.
Evaporation	0-20%	Inverse	10^4-10^6	100
Flocculation	0-20%	Independent	10	10
Ion Exchange	0-0.3%	Inverse	30-10^3	10
Electro-deionization	0-0.8%	Inverse	100	10

quired for zirconium-uranium alloys. At any rate, a waste solution will result from whatever chemical process is used to separate and purify the fissionable and fissile material. Since the fissionable and fissile material must be highly purified, several stages are required for the separation process, resulting in both high-level and low-level waste streams, and both must be properly disposed of.

Liquid Waste Disposal

The liquid waste generation picture is described in the diagram as printed below.

The high-level waste stream may consist of 10^5-10^7 gal per yr of an aqueous solution of various inert salts ranging from 0-20 percent of total solids contaminated with 10-100 parts per million of fission products. The activity level of such a waste would be high, so that even small samples of such waste would be dangerously radioactive.

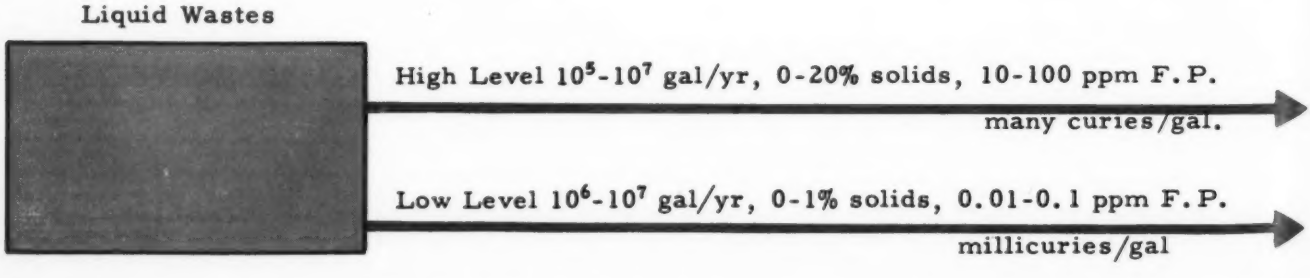
The low-level waste stream may consist of 10^6-10^7 gal per yr of an aqueous solution of various inert salts ranging from 0-1 percent total solids contaminated with 0.01 to 0.1 parts per million of fission products. The activity level of such wastes would be low—in the millicurie per gallon range.

Now that we have some idea of the character of liquid wastes, let us next consider several factors that will determine the approach we must take towards the disposal of these wastes. The first of these factors is product accountability. There will inevitably be some loss of fissionable or fissile material from the process, and since the product is not only extremely valuable but is also a product for which the plant is held accountable to the federal government and perhaps even to an international agency, the wastes must be carefully analyzed. The problem of accountability is considerably aggravated where enriched fuel is being handled, for here, in addition to an elemental analysis, an isotopic analysis will be required.

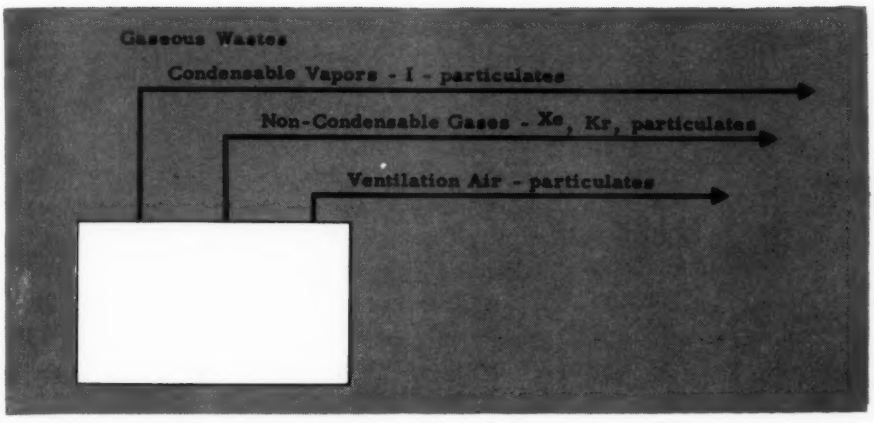
The next factor is hazards accountability. This defines the methods that must be followed to satisfy some regulatory agency that safe waste disposal practices actually have been employed. There will always be an economic temptation to simply let wastes flow into some convenient geological fault. However, such a practice would require the work of geologists, ecologists, and health physicists, and large outlays of capital for geological surveys, to demonstrate that it is indeed a safe practice. The cost of these studies would be part of the cost of disposal.

Keeping in mind both product and hazards accountability, the first approach to liquid waste disposal is direct storage in underground tanks. This procedure is adequate at remote locations for both high-level and low-level wastes. The cost of waste tankage depends upon the degree of control designed into the tanks required to insure containment. For very large tankage (10^6 gal) costs vary from $0.25 per gal to $1.50 per gal. For smaller tankage (10^5 gal) costs range from $0.20 per gal for low-level, noncorrosive wastes to $5-$10 per gal for high-level, corrosive, radioactive wastes.

These costs are for underground tanks, highly instrumented for leak detection, and heavily overdesigned for leak protection. They are planned for indefinite storage. There are several limits on underground storage, however, which tend to make this technique adequate for long-term rather than for indefinite time periods. The most important of these is corrosion. In any large chemical separation plant where restrictions are placed on wastes that may be discharged from the plant, and where storage tanks are provided, solutions of a highly varied chemical nature will inevitably find their way into those tanks. It is possible to design with some certainty


Liquid Wastes
High Level 10^5-10^7 gal/yr, 0-20% solids, 10-100 ppm F.P.
many curies/gal.
Low Level 10^6-10^7 gal/yr, 0-1% solids, 0.01-0.1 ppm F.P.
millicuries/gal

LIQUID WASTES CAN BE EITHER HIGH OR LOW LEVEL. DIAGRAM SHOWS QUANTITY AND CHARACTER OF LIQUID WASTE.


Gaseous Wastes
Condensable Vapors - I - particulates
Non-Condensable Gases - Xe, Kr, particulates
Ventilation Air - particulates

THE THREE TYPES OF GASEOUS WASTE THAT MUST BE HANDLED ARE SHOWN.

tanks that will withstand corrosion for periods of perhaps 20-30 years for systems whose chemical nature is well known at the start. It is impossible, however, to design with any certainty a metallic tank to contain aqueous solutions of unknown salts and guarantee it to withstand corrosion for the centuries that these wastes must be guarded before they can be safely released to the environment. Add to the corrosion problem the fact that nuclear radiation is creating oxidizing and reducing free radicals in the wastes, and the fact that appreciable amounts of heat can be generated by the absorption of radiation from the fission products, and you can see that waste storage is not as simple a problem as it might first appear. It is, in fact, one of the more troublesome of the engineering problems.

Reducing the Volume

Waste storage, then, is an interim solution to the waste disposal problem. It can be made adequate—at a cost. A glance at the previously mentioned cost and capacity data will indicate that investments in waste storage tanks may easily amount to millions of dollars per year at our proposed separation plant. There will be a strong economic driving force, therefore, to develop processes for reducing the volume of waste solutions that must be stored. There will be two criteria for such a process: (1) it must reduce waste volumes at a cost of less than that of simple storage; and (2) it must result in an effluent that can be safely discharged to the environment. In further defining the waste volume reduction problem, first assume that the high-level wastes are simply stored, and then consider the low-level wastes. Assume that 10^7 gal per year of low level waste is generated at 1 millicurie per gal. Then we must handle 10,000 curies per year. If the plant is located in a populated area, we are permitted to discharge 1 curie per year. We cannot immediately jump to the conclusion, however, that a decontamination factor of 10^4 is required for the volume reduction process. Consider the physical layout of the plant. It is highly probable that analytical labs, development labs, laundries, and other facilities will will each be handling several curies per year. Unless we design the waste collection facilities of the plant in such a way that each of these auxiliary facilities discharges its waste to a central collection system, the effluent from these auxiliary facilities may contribute heavily to the 1 curie per year permitted. Here, the decontamination factor required of the volume reduction process is more likely to be in the 10^5-10^6 range. Of course, if the plant is located in some remote area, a decontamination factor of only 10-100 would be required for low-level waste under the assumptions we have made.

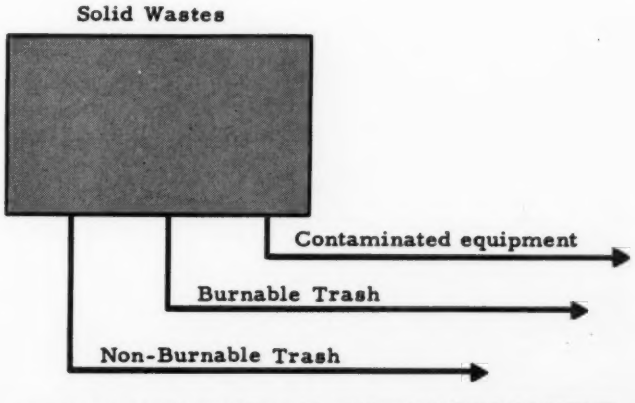
There have been two approaches to the development of a satisfactory volume reduction process:

¶ The physical separation of water and other solvents from the radioactive isotopes and from the other nonvolatile salts by evaporation.

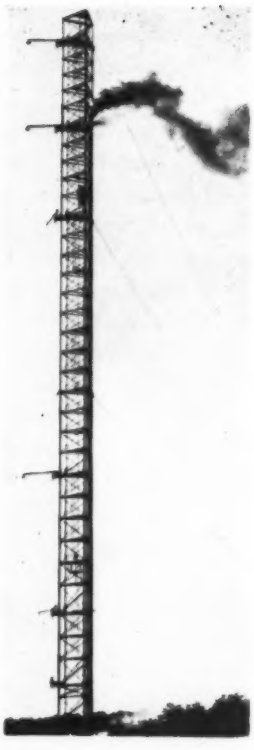
¶ The physico-chemical separation of the gross or specific radioactive isotopes from inactive bulk constituents by co-precipitation or ion-exchange techniques. The application of a particular type of treatment depends upon its relationship to the other variables in the system.

Within the present experience the only process that appears to have been successful in obtaining a decontamination factor of 10^6 is evaporation. Simple evaporators will ordinarily produce a distillate that has been decontaminated from the feed by a factor of 10^3-10^4. Standard de-entrainment devices do not improve much upon this factor, since the residual activity is carried over by aerosols. It is possible to achieve a 10^6 decontamination factor by employing a glass wool filter in the steam stream.

If a decontamination factor of 10^3 or less is required, the choice depends upon a cost balance between physical and physico-chemical methods. The efficiency of the physico-chemical method must be



TYPES OF SOLID WASTE ARE SHOWN IN THIS DRAWING.



HIGH STACKS DISPERSE GASES AT BROOKHAVEN.

predetermined for the actual system then under consideration.

If a decontamination factor of 10^3 is required and a high solids content within the solution to be treated is expected, it is unlikely that ion-exchange can be used. If there is a low solids content, ion-exchange or chemical precipitation methods can be used provided the efficiency of the treatment is predetermined and the chemical nature of the feed material is controllable.

The accompanying Table 2, from W. A. Rodger, indicates the cost of these various disposal processes for liquid waste.

To return to the high-level waste, several processes to reduce the volume of this type of waste and to convert it to a form in which containment is more assured are now in the development stage. One of these involves the absorption of the fission products on clay, and the subsequent fixing of the activity on the clay by firing. A second involves the conversion of the aqueous solution to anhydrous melts by calcining. A third involves the incorporation of the wastes into concrete. These processes are presently in the pilot plant stage, and it is difficult to assess their final applicability until they have been further developed and tested for a longer period of time.

PERFORATED CANS OF RADIOACTIVE MATERIALS ARE BURIED IN TRENCHES AND THEN COVERED BY BULLDOZER.

Gaseous Waste

Let us now proceed to gaseous waste disposal. The safe discharge of such wastes can sometimes be a major influence in site selection. In choosing a site, a complete climatological picture is required. The important parameters for gaseous waste disposal include wind speeds, wind direction and turbulence, air temperatures, and the nature of the surrounding terrain. Under some conditions there are only certain periods during which gaseous wastes can be dispensed to the atmosphere, and short-term meteorological forecasts are required to control such operations. Usually an area survey system must be set up to insure that safe limits are not being exceeded. The limits are usually set on the basis of the amount of external radiation an individual may safely receive during his lifetime. The tolerance levels set thus far by the AEC prescribe that no worker in an atomic energy establishment shall receive a radiation dose in excess of 300 milli-roentgen per week, and that the general public shall be exposed to no more than 35 mr in the same period of time. To give some idea of how the tolerance levels may be met, Brookhaven experience is of interest. Before Brookhaven was established, the background radiation level in the area due to the natural radon concentration in the air was approximately 1.5 mr per week. Since Brookhaven has been on stream, the background has not exceeded 1.55 mr per week. For comparison, fall-out from bomb tests has raised the level to about 20 mr per week although within one week this decayed back to background level.

Now, what sort of gaseous wastes are likely to be generated at the proposed separation plant, and what procedures must be followed to insure that stringent safety regulations are met.

The first operation in which gaseous wastes are likely to be generated is the dissolution of the fuel elements. In this step the gaseous fission products will be released. If the fuel elements have been stored for any appreciable time before dissolution, the only significant gaseous fission products will be iodine, xenon, and krypton. Physically these would be present in a few parts per million in a conceivable gas stream. Also of concern are particulates that have absorbed radioactivity and might be present in dissolver gases or in exhaust ventilation air.

Chemical methods can be employed for the removal of iodine from gas streams. Various air cleaning devices including cyclones, electrostatic precipitators, scrubbers, and filters can be used for the removal of particulates. The choice of equipment is usually limited by the efficiency of the device in removing aerosols.

A prime requirement for gaseous waste disposal will, of course, be a stack. The important parameters

in stack design will be the effective height and diameter of the stack and the temperature, velocity, physical nature, and mass rate of effluent. In general, it has been found that high stacks and warm effluents will decrease ground concentrations. The concentrations reaching the ground, perhaps 1000 ft away from the stack will be diluted at least 100 times. Taking the factors involved for the permissible ground concentration level and the efficiency of stacks, it should be possible for us to estimate the performance required of the gas cleanup equipment. A level of 35 mr per week is about equivalent to an activity concentration of 10^{13} curies per cc. Assuming a dilution factor of 100 from a tall stack, it would be permissible to discharge to a stack a gas with a curie content of 10^{11} curies per cc. The problem appears difficult, but it no doubt is soluble.

Solid Waste Disposal

The problem of disposing of solid wastes involves three general categories of solid waste: (1) contaminated equipment; (2) burnable trash; and (3) non-burnable trash. A description of how Hanford discards "hot" equipment was published in the May 1955, issue of *Nucleonics*. The techniques involved were as follows:

A remotely operated crane in the separation plant lifted the hot piece of equipment with attached piping from a cell, placed it in a metal-lined wooden box on a railroad flat car, and bolted down a lid.

—Continued on page 84

MEDIUM ACTIVE WASTE IS PIPED FROM WINDSCALE TO THE SEA.

Disposal of Radioactive Waste

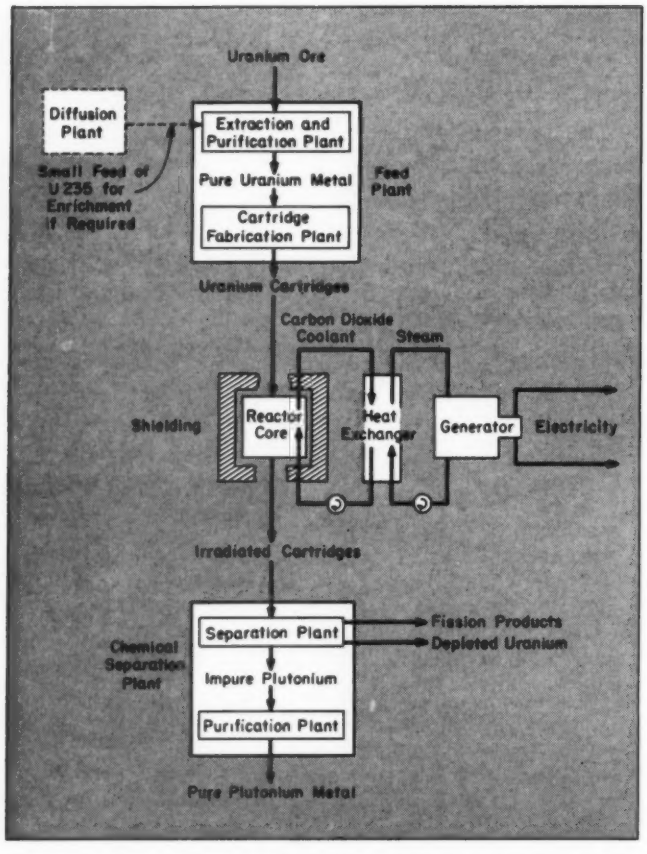
Part 2 . . . . The British Approach

LEO WALTER, Consulting Engineer

CE exclusive

AMONG THE MANY PROBLEMS confronting the consulting engineer dealing with atomic plants and nuclear power stations, the disposal of radioactive waste products is among the more complicated. Once privately owned nuclear power plants come into use in many countries (in addition to state-owned nuclear power stations) the problem will be to dispose of large and steadily growing amounts of contaminated products, ranging from radioactive exhaust gas and liquid to solid waste products.

In Great Britain, a program of 16 nuclear power



COMPLETE PROCESS INVOLVING URANIUM AS NUCLEAR FUEL. WASTES ARE REMOVED IN SEPARATION PLANT.

plants has been announced by the British Atomic Energy Authority, and it is this body that will lead in finding solutions to disposal problems of radioactive waste. The Authority has a number of state-owned research establishments that are already engaged in vigorous investigations. The results will be available at some later date for the consultant who has to deal with privately owned nuclear plants, either in Great Britain, in countries of the British Commonwealth, or in other countries where British built atomic power plants will be installed.

Present Disposal Methods

In a booklet published in June 1955, Mr. K. E. B. Jay, of the British Atomic Establishment, in Harwell, deals with the problems of waste disposal. In this booklet entitled *Atomic Energy Research at Harwell,* the methods used for disposal of radioactive effluents from the primary separation plant are briefly described.

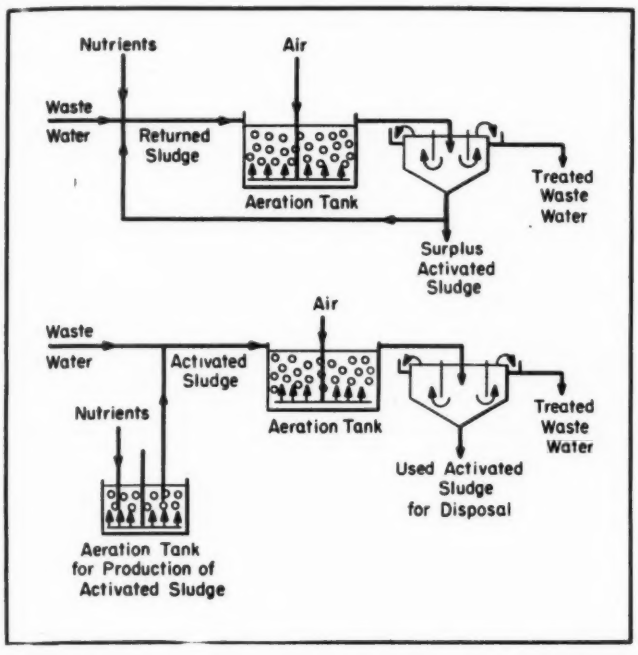
After the formation of the United Kingdom Energy Authority, in August 1954, the Atomic Energy Research Establishment, at Harwell, did research work on production of uranium metal at the Springfield works, on transmutation of uranium into plutonium in atomic piles at the Windscale works, and on separation of plutonium from irradiated uranium, also at Windscale. Disposal of the final product from the primary separation plant — the highly active solution of fission products — is said to have presented some difficulties. In addition to effluent disposal from the Windscale plant, other disposal problems have arisen at Harwell, itself. Mr. Jay has this to say about both problems.

"A large part of the activity arises from the long-lived fission products, for example, cesium-137 with a half-life of 33 years. If this were not so the solution could be stored for a year or two, until the activity had decayed to a low value, and then be discharged to sea. In fact this is done with the effluent of low activity at Windscale. The sea already contains very large quantities of radioactive elements (there are a hundred million grammes of radium and a thousand million tons of uranium in the Atlantic Ocean for example) and a little more, provided it is well dispersed, will make no difference. The highly active waste, however, is far too "hot" to be discharged, and so far there has been no use for it. It is stored indefinitely in well-protected stainless steel tanks after its volume has been reduced as far as possible by evaporation. In the future, however, it is probable that these highly active solutions will be used, either mixed or separated into individual radioisotopes, as strong radioactive sources for industry and medicine. Both Harwell and the Industrial Group are studying possible methods of doing so. Already cesium-137 is being separated on a small scale from mixed fission product solutions at the Radio-Chemical Centre, Amersham, and a much larger separation plant is being built by the Industrial Group, at Windscale, for this purpose.

"There are disposal problems at Harwell too. A great deal of material and equipment is accumulated, during the course of research, which is mildly contaminated with radioactivity. This stuff is in no way dangerous to handle but it cannot simply be dumped on a refuse heap because it might get into circulation and come back to Harwell, where it would upset measurements, or get to a manufacturer of photographic films and fog his films. The Establishment is therefore looking for suitable ready-made holes, such as disused quarries and mine shafts, where this rubbish could be dumped without costing the taxpayer the expense of digging new holes. The total activity in a year's accumulation of such refuse would be small compared with natural accumulations — for example, a comparable amount can easily fall as rain in the course of a year. Such operations do not therefore present any public hazard though they have given rise to much public discussion and anxiety. . ."

Public Anxiety

Near my home, in England, there is a rural area of great beauty called "The Forest of Dean." For many miles one can drive through lovely rows of



FLOW DIAGRAMS SHOWING TWO ALTERNATIVE METHODS FOR TREATMENT OF WASTES WITH ACTIVATED SLUDGE.

old trees and green meadows; suddenly this is darkened by high heaps of ugly material. These are wastes from coal mines that have been worked in this forest for hundreds of years. Some are still worked on a small scale by mining communities.

The great number of disused but fairly deep mine shafts drew the attention of the authorities to these "safe" places for disposal of radioactive solid materials, and it was announced that certain old mine shafts would be used as dumping places, then filled up with material from adjacent earth and stone heaps. This announcement produced vigorous protest from the inhabitants of various villages in the forest. Protest meetings disclosed that the population was afraid that gradually the ground water might become contaminated. The miners objected because they feared that water in the active mines might become dangerous to them. The ultimate result was that the whole project of disposal of radioactive wastes in deep unused coal mine shafts had to be abandoned. However, burying of radioactive solid wastes in disused quarries and deep holes in the ground is being done in some areas.

In an interesting booklet, edited by Dr. J. Rotblat, Dr. J. F. Lontit mentions as the main hazard the fission products. They are concentrated sources of the penetrating gamma rays, but these products decay to stable elements, and if concentrated to a small volume, they can be made insoluble in water and will not powder. The sea obviously provides a very large volume of water into which these concentrated waste products can be dumped, and then be dispersed by the sea water.

In carrying out this method of dumping of dangerous fission waste products, a deep, unprotected sea area is desirable. Further, there is the need for high concentration of the atomic waste products before dumping into the sea. At the present time (and until better methods have been found) the British Atomic Energy Commission deposits moderately radioactive material in a dumping ground in the English Channel called "Hurd Deeps." This short-lived material is enclosed in drums made of mild steel. When the sea water corrodes the steel, the radioactive material is gradually dispersed without building up any serious concentration of radioactivity in the sea water.

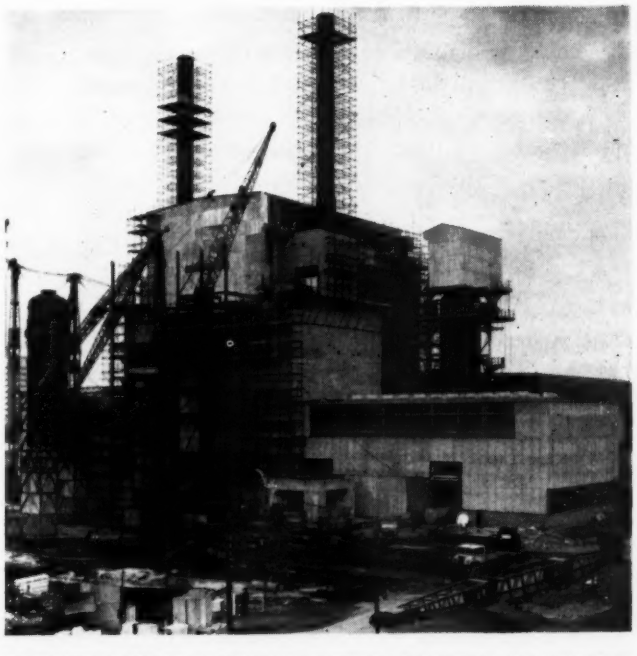
Material of higher concentration is dumped into the Atlantic Ocean, carefully sealed in large concrete containers. These substances disperse radioactivity slowly according to the laws of radioactive decay. Both sea areas have been approved.

It seems that the British method of disposal of solid wastes is safer and probably costs less than the American method of burying sealed steel tanks in remote fenced areas at costs as high as $5-10 per gallon. With increased use of atomic power and of radioisotopes, some means of safe transport to the sea may have to replace the present burial ceremonies in U.S.A. atomic plants.

Treatment of Water Pollution

Several papers have been published describing the work carried out by the Water Pollution Research Laboratory, of the Department of Scientific and Industrial Research, at Stevenage, Herts., England. At a recent opening ceremony of a radiochemical exhibit the following details were given.

"The developments now taking place in the gen-



BRITAIN'S FIRST NUCLEAR POWER STATION AT CALDER HALL IN CUMBERLAND, NOW UNDER CONSTRUCTION.

eration of electricity from atomic energy and in the use of radioisotopes in Great Britain will greatly increase the quantity of radioactive waste materials produced. The British Ministry of Housing and Local Government has asked the Water Pollution Research Laboratory to investigate the fate of radioactive substances discharged to streams, and this will be done using a section of the new laboratory which has been specially designed for radiochemical research work.

Removal in Normal Treatment

"Previous radiochemical work at the laboratory has included an investigation of the extent to which radioisotopes, which may enter water supplies as a result of attack with atomic weapons or in waste waters, are removed by the treatment processes normally used at a water works. It was found that although these processes will not remove all radioisotopes likely to be present in contaminated water, a comparatively high proportion of some isotopes is removed. For example, over 90 percent of the radioiodine present was removed by coagulation with alum, provided that a small quantity of silver nitrate was first added. Coagulation was not a satisfactory process for removing radiostrontium, but over 97 percent of this isotope was removed when the water was softened by ion exchange. The radiochemical section of the laboratory also assists the work of other sections, for example in the use of 'tracer' techniques for determining periods of retention in tanks, filters, and other systems."

Details of the purification of domestic water supplies for removing radioisotopes, were given in two papers dealing with radioiodine and with radiostrontium. The first paper describes a rapid and convenient method or removal of radioiodine-1131 from hard water during a conventional treatment process by using coagulation, partial sedimentation, and rapid sand filtration, on a laboratory scale. The second series of laboratory tests for removal of radiostrontium used ion exchange after addition of coagulent and softening by chemical methods.

Biological Treatment

An interesting method for removal of radioactive substances from water by biological treatment processes was described in detail in a paper published by members of the Water Pollution Research Laboratory. Slow sand filtration is used, with good results. Activated sludge process treatment with aeration whereby the active sludge and the purified effluent are separated by sedimentation has been investigated at Stevenage for the radioiodine-1131, strontium-90, ruthenium-106, cerium-144, cesium-134 and plutonium-239. It was concluded that biological treatment would result in useful reduction of activity, but it has to be followed by chemical methods. Biological treatment may also be useful for treatment of effluents that are not amenable to purely chemical methods, for example those containing organic complexes of radioisotopes.

Conclusion

The dangers of radioactive material are not new. The use of radium, X-rays, and other emanations has produced internationally agreed standards, and they will also cover radioactive materials produced by fission of uranium or other atoms. These new standards can be expected to be stringent and are based on several years of international practical experience in atomic plants in the United States and Great Britain and in "hot" laboratories in several other countries. Instances such as the "running away" of the Canadian nuclear reactor at Chalk River, and recent experiments where a small reactor built in U.S. was deliberately allowed to get out of control contributed enormously to knowledge about possible hazards.

Strontium-90 has a "half-life" of about 25 years, and emits electrons when it breaks down. Cesium-137 has a half-life of about 33 years and emits powerful gamma radiation. If these two medium-life elements can be separated from remaining fission products, the problem of long term disposal will be reduced to practicable solutions. Very short lived elements can then be temporarily stored for a few months so that they become harmless. The small group of very long lived elements are so stable that their rate of radiation is very small.

In Great Britain a pilot plant at the plutonium factory, at Windscale, in Cumberland, is in construction and will continue research on the all-important separation problem. It is now thought that waste from high-power reactors used in nuclear power plants can be processed and separated satisfactorily. If the whole present electricity output of Great Britain were to be generated from nuclear energy, only about 1 to 2 tons of strontium-90 and cesium-137 would (after suitable continuous separation) have to be disposed of. Neither volume nor weight of this waste material presents insurmountable difficulties for disposal, and dumping into the sea would seem to be practical, although cost of this as compared to burial in the soil is yet to be determined. ▲▲

BIBLIOGRAPHY

Jay, K.E.B., *Atomic Energy Research at Harwell,* Butterworths Scientific Publications, London, 1955.

Eden, G. E., Elkins and Truesdale, "Removal of Radioactive Substances from Water by Biological Treatment Processes," *Atomics,* Vol. 5, May 1954.

Eden, Downing and Wheatland, "Observations on the Removal of Radio-Isotopes during Treatment of Domestic Water Supplies," *Journal of Inst. of Water Engineers,* Vol. 6, Nov. 1952 and Vol. 7, Nov. 1953, London.

Jay, K.E.B., "Britain's Atomic Factories," *H. M. Stationary Office,* London, 1954.

Rotblat, J., "Atomic Energy—A Survey," For Atomic Scientists Assoc. by Taylor & Francis Ltd., London, 1954.

Dutch Consultants Cooperate On Foreign Jobs

FRITZ HIRSCHFELD
European Editor

PROGRAMS DESIGNED to assist under-developed countries achieve higher standards of living offer interesting opportunities for consulting engineers. These programs are extensive in scope—perhaps involving a complete hydroelectric development tied in with a comprehensive irrigation scheme; or a land drainage and reclamation project in conjunction with community planning. Since they often entail engineering talent and facilities not usually found in any one consulting firm, the Dutch, in 1951, established an organization called NEDECO (Netherlands Engineering Consultants) to tackle the problems associated with these overseas projects.

NEDECO is an association of Dutch consulting engineers who have secured the cooperation of the Dutch government, authorities in private and public institutions, and specialists in engineering as well as in other fields. They are in a position to offer the most complete and up-to-date facilities for the engineering design and supervision of all phases of a technical development program.

A permanent staff of experienced engineers, with offices in The Hague, is responsible for preparatory work and coordinating activities on development programs. NEDECO's recommended procedures are based on a reconnaissance of the scope and extent of the required engineering, coupled with investigations to determine the physical and economic feasibility of these proposals. With the client's approval of the initial steps, NEDECO can then go ahead with cost estimates, preliminary reports outlining alternate procedures, preparation of plans and specifications, supervision of construction, and, if necessary, provide operational assistance. The permanent Hague staff and the consulting engineer associates do not carry out any construction work themselves but, in accordance with their articles of association, act only as consulting engineers. NEDECO is distinctly separate, in theory as well as in practice, from any contractors or manufacturers.

News of a potential project may reach NEDECO through a number of different channels. They may be approached by a foreign government that is already aware of their experience on similar jobs. Dutch government representatives or private Dutch commercial interests might cooperate with NEDECO by calling their attention to prospects and by indirectly promoting the activities of the group among potential clients.

The permanent NEDECO staff works on the initial stages of a proposal. Once a definite commitment is made by the client, the actual planning, design, and supervisory work is carried out by the various associated consulting offices, architects, scientific and agricultural laboratories, and other institutions in Holland. The specific work assignments are determined and coordinated by the permanent staff with the full knowledge and consent of associated members. NEDECO's time and overhead expenses chargeable to a client are included as a part of the over-all consulting engineering costs.

In this manner, the permanent organization is completely self-supporting.

Ten civil and industrial engineering firms, two agricultural engineering companies, and one airport consultant are the principal associates. Other consultants can be called in as required, but these thirteen firms form the backbone of the organization.

The flexible form of cooperation under which NEDECO functions makes it possible to pool expert engineering knowledge and experience and to further enlist the services of experts on matters that fall outside the scope of engineering. For example, it is frequently necessary to consult specialists on agricultural subjects for problems relating to reclamation or irrigation. Expert advice on matters of administration or organization may be required for projects having to do with water, rail, road, or air transport. An industrial assignment may call for special knowledge in such diverse fields as productivity, labor relations, or accounting procedures.

NEDECO was founded in 1951 with help of an original grant of approximately $130,000 from various private sources. However, the group has always retained full control of its operations and is in no way responsible or obligated to the original founders nor to the Government. The founders have taken the viewpoint that getting NEDECO started is an investment in boosting the Dutch economy. The foreign consulting assignments during the past four years have been so successful that today the group is on a paying basis and has justified all the earlier expectations.

Organizational Setup

A look at the Board of Directors responsible for governing NEDECO closely defines its independent engineering character. The president of the four member Board is a civil engineer, formerly Director-General of Public Works at Rotterdam, and now in private practice as a partner in a consulting architect-engineer office. Another member of the Board is also a private civil engineering consultant. A third member is Director of the Netherland Trading Co. in Amsterdam. And the fourth member is a civil engineer, formerly General Secretary of the Department of Transport and Public Works in Indonesia (till 1949 Indonesia was a Dutch colony), afterwards Deputy Secretary of the Royal Institute of Engineers in Holland, and now Professor at the Technical University in Delft.

The members of the Board are elected by two groups: the Supervisory Board representing the founders of NEDECO, and an Advisory Council. The Council is appointed by the Royal Institute of Engineers; the Ministers of Foreign Affairs, Public Works, Economic Affairs, Agriculture; the Technical University at Delft; the Agricultural University at Wageningen; and the Dutch General Organization of Research and Applied Sciences.

There are two permanent managers directly responsible for guiding NEDECO's activities. Both men have had many years of experience as engineers. It is interesting to note that their backgrounds are in the fields of reclamation, the type of work in which NEDECO is primarily engaged. Mr. E. W. H. Clason was in Indonesia from 1927 to 1950, where he specialized in irrigation works, roads, town-planning, and colonization projects. Mr. B. D. H. Tellegen has been a consulting engineer since 1923, and his record includes world-wide experience in the fields of reclamation work, ports, inland waterways, flood-control, and related hydraulic engineering assignments.

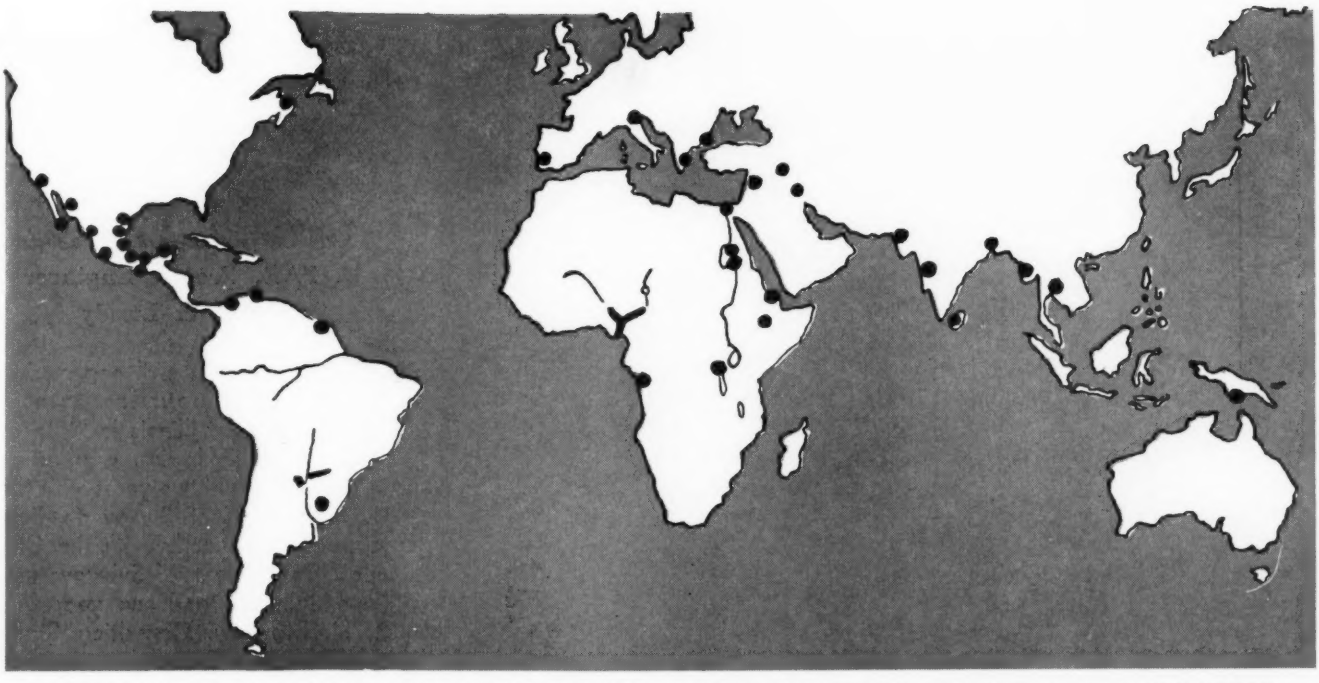
Outside Assistance

NEDECO's major field of activity is in hydraulic engineering followed closely by agricultural engineering. Traffic and city engineering (including public utilities) are generally considered an integral part of any community development plan based on land reclamation and irrigation. This work can be supported by the survey and laboratory research facilities available to NEDECO in the Netherlands. At Delft, for instance, the Scientific Survey Centre is prepared to assist in topographical, terrestrial, and aerial surveys. Test and model investigations can be studied at the Hydraulic Laboratory, and subsoil investigations and analyses come under the Laboratory of Soil Mechanics.

The Dutch, of course, are particularly well equipped to deal with problems regarding irrigation and reclamation because of many years of direct experience in their own country building dikes, reclaiming land from the sea, and guarding against floods. It is not an exaggeration to say that the very existence of the Netherlands has depended on the ability of their engineers to solve these hydraulic problems. Since much of the work in the under-developed areas of the world is concerned with similar problems, Dutch experience is a decided advantage.

Also, for centuries the Dutch have governed an extensive colonial empire in the East and West Indies. Indonesia, the largest of the Dutch colonies before its independence in December 1949, afforded Dutch engineers and administrators firsthand experience in how to work under tropical conditions.

NEDECO has compiled an impressive work record in its four years of existence. Part of this record is worth mentioning as an example of the type of work being carried out and the importance of these projects. In Mexico, in 1954-55, the group prepared a report on the general program of port development for the Mexican government. A study on the unification and renewal of track and bridges of the Turkish State Railways was made for the International Bank in 1953. Coal mining and industrial problems related to the National Coal Plan were analyzed in Brazil for the Brazilian National Re-



BETWEEN 1951, WHEN IT WAS FORMED, AND 1954, NEDECO HANDLED ENGINEERING PROJECTS AROUND THE WORLD.

search Council in 1952-53. NEDECO is presently conducting a general study and investigation of conditions existing in the Niger and Benue River System for the Nigerian government to determine how the shipping conditions can be improved.

A major project on which the preliminary phases were completed in 1952-53 was a multiple purpose scheme in the El Ghab Valley for the Syrian government. This work included the reclamation of marshes, irrigation of reclaimed and dry land, accumulation reservoirs, waterpower, agricultural exploitation, farm buildings, highways and road system, town and village planning, and fisheries. When completed, the El Ghab Valley project will represent one of the most comprehensive and ambitious development schemes in the Middle East for making a desert area productive.

In addition to the work mentioned, projects are in progress or have been completed in Greece, Portugal, Egypt, Sudan, Ethiopia, Eritrea, India, Burma, Thailand, Pakistan, Surinam, Portugese Cabinda, Belgian Congo, Rhodesia, and New Guinea.

Reasons for Success

There are several reasons that account for NEDECO's success. For one thing, they have followed the precepts and ethics of consulting engineers and have positively avoided any connection with commercial or manufacturing interests. The fact that they can offer unprejudiced and objective technical assistance seems to be a big selling point among the governments of the underdeveloped countries. Also important is the fact that the group can draw upon engineering and non-engineering specialists as well as all the important research and development institutions in Holland. NEDECO has been careful to stress its abilities only in those fields in which Dutch consulting engineers have had extensive experience.

Groups in Other Countries

Holland is by no means the first or only country to organize its consulting engineering and related technical facilities on a national basis for the purpose of carrying out foreign work. NORENO (Norwegian Engineering Export Organization) was formed in Oslo, Norway, in 1950, for more or less the same purposes. To date, NORENO has not been nearly as successful; probably because the Norwegian group is tied too closely with commercial interests. Groups similar to NEDECO have been formed in France, Belgium, Germany, and perhaps also in other countries. However, so far, NEDECO has had the most outstanding success when judged by its work record and by the business-like and profitable functioning of the staff and their associates in this venture.

It is quite likely that in a few years each of the developed countries of Europe will pool its engineering talents and technical knowledge in order to participate in the work of industrializing and raising the standards of living in the underdeveloped areas of the world. And the chances are that these organizations in the developed countries, while continuing to compete with each other, will also find it mutually advantageous to cooperate in those fields in which each has gained special experience or learned improved techniques. ▲▲

VIEW OF 250-FT BRICK CHIMNEY AT HENNEPIN STATION, ILLINOIS POWER CO.

M. ZAR, Project Engineer
Sargent & Lundy

Mr. M. Zar is a civil engineering graduate of Armour Institute of Technology (now Illinois Institute of Technology.) Following graduation in 1938, he spent two years with the U. S. Geological Survey on field mapping, six months with the Chicago Department of Subways and Superhighways, and one year with R. H. Maveety, Consulting Structural Engineer. Except for seventeen months with a naval architect on the design of vessels for the Bureau of Ships, he has been with Sargent & Lundy since June, 1942. After five years as chief draftsman in the structural department, he became project engineer in 1952.

Solving Tall Chimney Design Problems

CHIMNEYS for steam power plants appear to be growing skyward. As their height increases, the problems related to their design grow in magnitude. Utilities consistently are purchasing turbogenerators of greater capacities in an attempt to keep step with an accelerated growth in load. Larger turbines mean larger steam generators, and increased quantities of flue gas.

Just as engineering thinking must keep pace with progressively larger installations, so must the old concepts of handling flue gases be readjusted. Most of the fly ash can be removed from the discharge by means of precipitators, but dispersing these larger quantities of objectionable fumes without provoking the nearby countryside can only be accomplished by increasing the stack height or the velocity of the exhaust gases.

This problem resolves itself into an intelligent balance between engineering economics and public relations. It is an attempt to keep gaseous downwash within acceptable limits—to minimize the number of hours per year when the stack plume dips too close to the ground. Surrounding topography, adjacent structures, meteorological conditions, and gas exit temperatures, volumes, and velocities all affect the plume. Also, the intensity of the SO_2 odor is a function of the amount of sulfur in the fuel. Wind tunnel experiments have done much to help predict the behavior of these discharges.

Costs Vary With Plant Site

In selecting a site for a coal fired power plant, it always has been necessary to evaluate the costs of fuel delivery, the availability of circulating water, the suitability of the area for satisfactory structural foundations, and the proximity of the electrical load center. It well may be that the chimney requirements for one site as compared with another would show a significant cost differential. This should not be ignored in the planning estimates.

Before any stack heights are firmly established, proper precautions should be taken to insure that these structures will not present a hazard to air navigation. Owners of proposed chimneys are required by law to notify the Civil Aeronautics Ad-

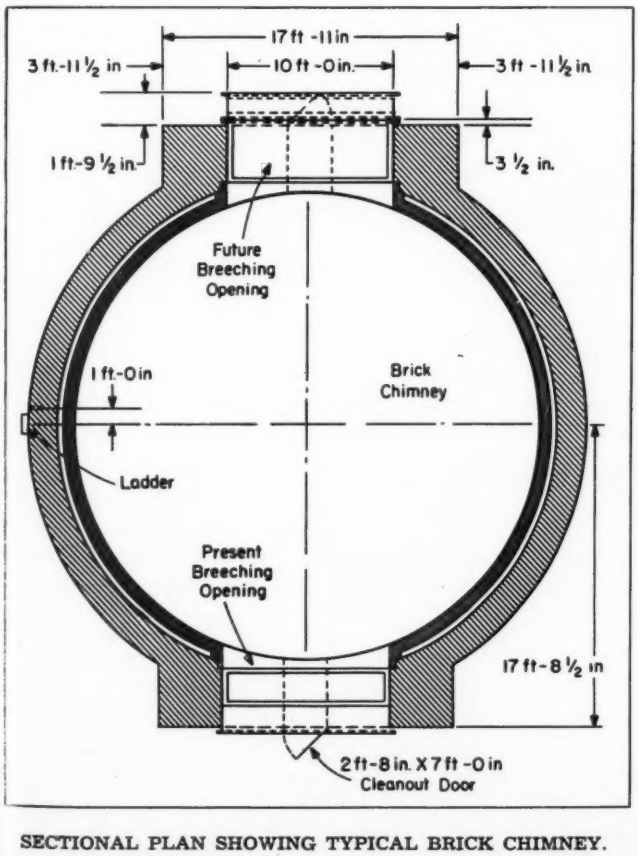
ministration of the location and size of the contemplated structure. The C.A.A. then will serve notice of their approval or objections and will recommend whether or not the chimney shall be lighted, painted, or both. When the height is limited by prevailing flight patterns, the only choice is to increase the exit velocity of the gases.

Selecting the Stack

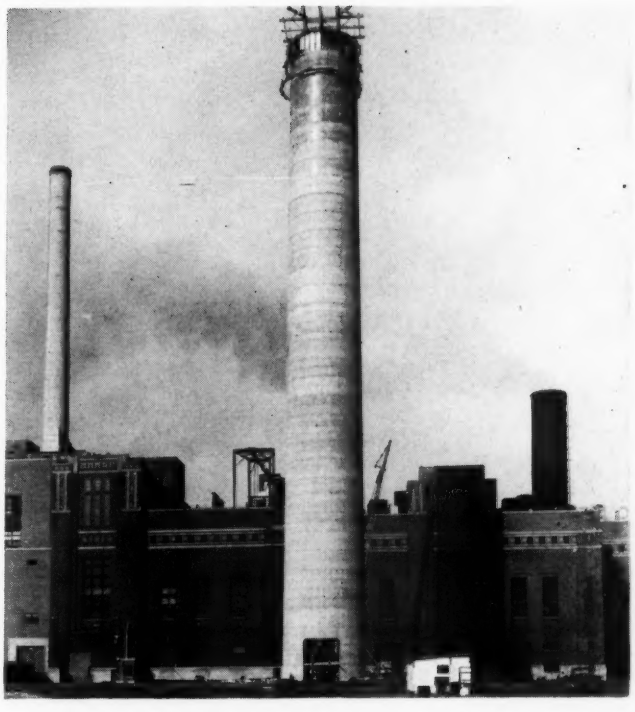
After the stack height above grade and the inside diameter at the top are established, various types of stack construction are investigated, including: (1) steel stack supported on the roof of the station, (2) steel stack supported on a steel tower and separate foundation, (3) steel stack supported at grade on its own foundation, (4) concrete chimney supported at grade, and (5) brick chimney supported at grade. (Roof-supported chimneys of brick or concrete of the sizes required for modern stations add tremendous weights to be supported by the steel frame and are not economical.)

Since the selection of the proper type of stack to use for a given plant is primarily an economic evaluation, the following information may be helpful in making comparative studies.

¶ For stacks that are less than 300 feet above grade, a lined steel stack on the roof may be preferable if its supporting steel can be joined to other girders and columns already carrying heavy equipment loads. Usually, the substructure design is such that additional loads on heavy foundations are not very costly to support.



SECTIONAL PLAN SHOWING TYPICAL BRICK CHIMNEY.



INCOMPLETE 400-FT HIGH CONCRETE CHIMNEY. THERE ARE TWO DUST HANDLING FLOORS AND AN 800-TON FLY ASH SILO ABOVE THE TRACK OPENING THROUGH BASE.

¶ The plant area may be too congested to permit locating a separate foundation close to the station. A rough solution for the size of a foundation (which can be used for layout purposes) can be calculated from the formula:

$$D = d + \frac{h}{10}, \text{ where}$$

D is the short diameter of the octagonal footing
d is the top diameter of the chimney
h is the height of the chimney above grade.

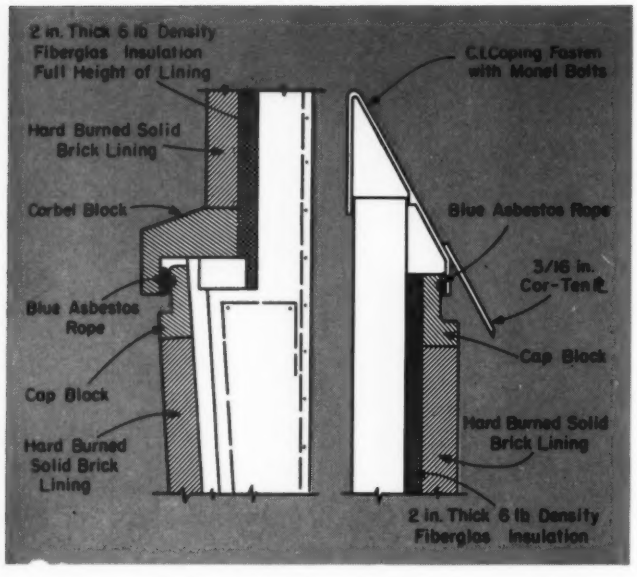
¶ Chimneys supported outside the building generally require more ductwork. (If the plant layout studies have located the precipitators and induced draft fans outdoors, this may not be true.)

¶ Many owners of power plants of the 25-yr old variety find that they must build taller stacks, either because of recent urban development in their vicinity or because of greater concern over air pollution. Frequently, it is difficult and costly to extend existing roof-supported steel stacks. The solution usually lies with self-supporting structures.

¶ Chimneys supported at grade generally have space available below the breeching openings that can be utilized profitably for other purposes.

¶ Occasionally, the cost of the separate foundation can be reduced if the chimney can be placed on top of an outside structure that, by itself, requires a heavy substructure.

¶ On most projects the cost of a four-column tower


2 in. Thick 6 lb Density Fiberglas Insulation Full Height of Lining
C.I. Coping Fasten with Monel Bolts
Hard Burned Solid Brick Lining
Corbel Block
Blue Asbestos Rope
3/16 in. Cor-Ten ℄
Blue Asbestos Rope
Cap Block
Cap Block
Hard Burned Solid Brick Lining
Hard Burned Solid Brick Lining
2 in. Thick 6 lb Density Fiberglas Insulation

TYPICAL CORBEL (LEFT) AND COPING (RIGHT) DESIGN DETAILS OF GOOD CONCRETE CHIMNEY CONSTRUCTION.

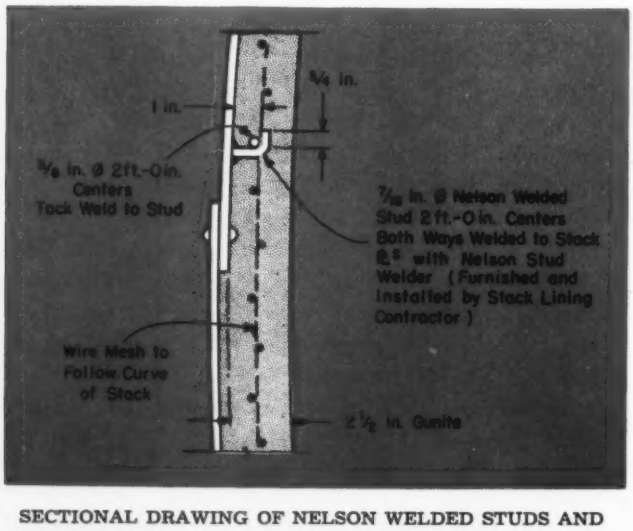
under a steel stack does not vary much from that of extending the stack from the breeching opening to the foundation.

Sample Comparisons

In different parts of the country, the relative costs of various types of construction fluctuate with local labor, material, and freight rates, but general comparisons can be drawn from actual construction costs.

¶ A steel stack on a 100-ft high building runs from 10 to 15 percent less than a steel stack that is supported on its own foundation.

¶ For stacks up to a height of 150 feet, supported at grade, there is little difference between steel, brick, and concrete construction costs. In general, the steel stack will tend to be slightly lower.

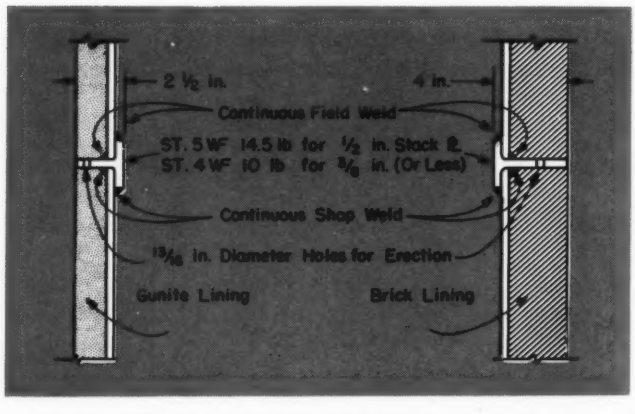

1 in.
¼ in.
⅜ in. Ø 2 ft.-0 in. Centers Tack Weld to Stud
⅞ in. Ø Nelson Welded Stud 2 ft.-0 in. Centers Both Ways Welded to Stack ℄ with Nelson Stud Welder (Furnished and Installed by Stack Lining Contractor)
Wire Mesh to Follow Curve of Stack
2½ in. Gunite

SECTIONAL DRAWING OF NELSON WELDED STUDS AND WIRE MESH FOR GUNITE LINING IN A STEEL STACK.

¶ For stacks over 150 feet, standing on the ground, brick is consistently the most expensive and concrete the cheapest. This has been checked for a range of inside diameters from 10 to 24 feet. For example, for a 400-ft stack of 10-ft diameter, brick will cost about 50 percent more than steel and 125 percent more than concrete. With a diameter of 24 feet, brick would cost 20 percent more than steel and 100 percent more than concrete.

Stack Linings

In these comparisons, brick linings were figured throughout. Lumnite gunite linings for steel stacks cost about one-third less than vitrified brick laid in silica sand-lumnite cement mortar, but these linings are somewhat more susceptible to corrosion from low-temperature, high-sulfur coal gases. Chimneys subjected to excessive sulfuric acid condensation, especially if they are of large diameter and are in service primarily during peak loads, should have linings of vitrified brick laid in acid-resisting chemical mortars. Most of these are silicate of soda. Phenolic resins are more expensive, but are very good if high temperatures are not encountered. Potassium silicate mortars, just being introduced

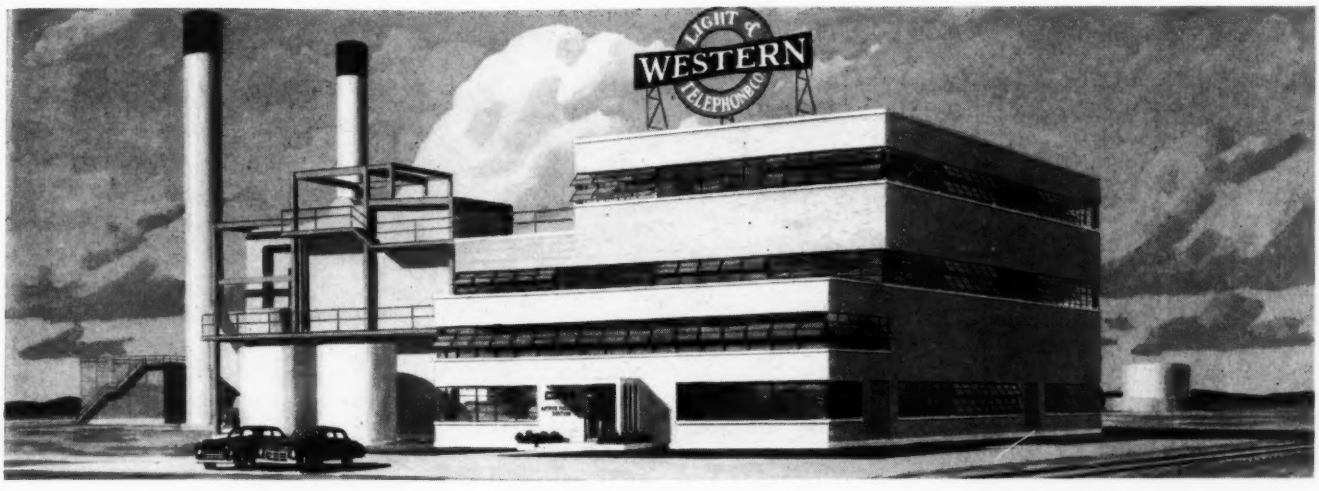

2 ½ in.
4 in.
Continuous Field Weld
ST. 5 WF 14.5 lb for ½ in. Stack ℄
ST. 4 WF 10 lb for ⅜ in. (Or Less)
Continuous Shop Weld
13/16 in. Diameter Holes for Erection
Gunite Lining
Brick Lining

VERTICAL SECTION THROUGH WELDED STACK JOINTS FOR GUNITE LINED STACK AND BRICK LINED STACK.

in this country after years of use in Europe, are quite costly at present.

Design Fundamentals

Most concrete chimneys are designed in accordance with the American Concrete Institute's, "Standard Specifications for the Design and Construction of Reinforced Concrete Chimneys," A.C.I. 505-54. The brick lining should extend the full height of the chimney, and it is either independent of the shell or supported on corbels with provisions for lining expansion at each corbel. There is either a 2-in. air space or insulating material between the lining and the shell. The A.C.I. code covers wind loading; hurricane and seismic loads are special



ARCHITECTURAL RENDERING OF A POWER PLANT WITH TWO STEEL STACKS SUPPORTED ON FOUNDATIONS AT GRADE.

Allowable stresses for wind, temperature, and dead loads are controlled by table and formula.

The design of radial brick chimneys often is controlled by local code. Initially, wind forces and service temperatures, internal and external, are established. Many specifications require that with all forces acting, the mortar stresses shall not exceed 20 lb per sq in. tension and 200 lb per sq in. compression. This would permit the use of a mortar mix consisting of 1 part Portland cement, 2 parts lime, and 5 parts sand by volume. The brick should have a minimum weight of 120 lb per cu ft. The brick lining should extend the full height, and it generally is supported on corbels and separated from the shell with a ventilated air space.

Concrete and brick chimneys properly designed to resist these forces have too much mass and stiffness to be subject to excessive deflection or vibration. However, steel stacks do not have the high inertia and good damping characteristics that are inherent in masonry construction and require deflection investigations.

In the Midwest, where hurricane and seismic forces are uncommon, it is customary to load the projected area of the steel stack with a horizontal wind load of 25 to 30 lb per sq ft — roughly equivalent to winds of 100 to 120 mph. The combined stress due to dead and wind loads should not exceed 1.33 times the allowable stress obtained from the formula:

$$f_s = \frac{2{,}000{,}000}{D/t}\left[(2) - 2/3\left(\frac{200}{D/t}\right)\right], \text{ where}$$

f = allowable unit stress in lb per sq in.
D = diameter of stack in inches
t = plate thickness in inches

The top course, where the greatest danger from corrosion exists, should be a minimum of 3/8-in. thick. Unlined stacks should have a 1/16-in. increase in the plate thickness for the full height as an allowance against the corrosive effects of the gases.

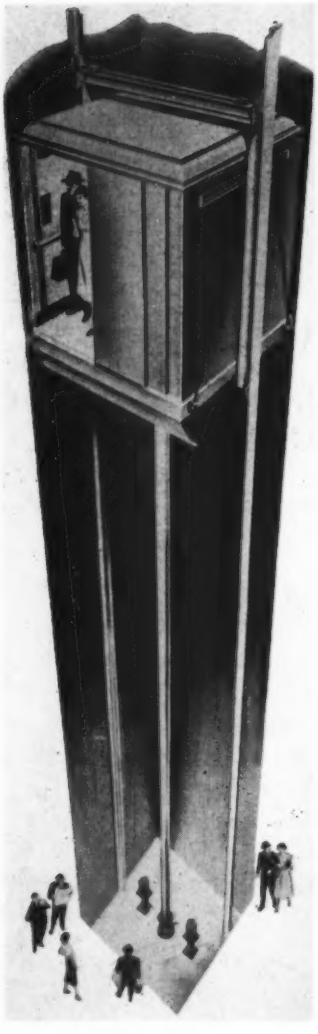
A steel stack whose diameter at any section is at least 1/11 of the height of the stack above that section will be found to have nominal cantilever deflections if designed in accordance with the formulas given. The total deflection is that due to cantilever action, supporting steel deformations, and anchor bolt elongations. To keep these last two to a minimum, the girders should have a depth to span ratio of 1/6, and the anchor bolts should be kept as short as practicable and should be designed for a stress of about 8000 lb per sq in. on the gross sectional area.

Forms of Stack Deflection

Stack deflections take two forms: cantilever vibration—the periodic sway perpendicular to the wind direction; and ovalling vibration—a periodic flattening of the shell. When the wind hits a stack, vortices form alternately on each side, perpendicular to the wind direction. As they form they build up negative pressure, causing movement.

Every stack has its own natural frequency, and resonance occurs when this frequency corresponds with that of the alternating load resulting from vortex shedding. The damping characteristics of the stack, including the lining and supporting structure, dissipate the energy input of the wind. There is ample reason to believe that failure can occur at resonant wind velocities considerably below the high velocities from which the static pressures of 25 or 30 lb per sq ft are derived. These excessive deflections at low wind velocities have been observed in the field. When these stacks were analyzed for natural frequency, using successive approximations, they were found to be swaying in resonance.

Ovalling vibration exists when the frequency of the alternating wind loads are resonant with the natural frequency of the stack shell considered as a ring. Circular stiffeners should be used when necessary to provide a resonant wind velocity above the maximum expected wind velocity. ▲▲



FLOYD E. WILLISON

Floyd E. Willison has had an extremely varied career. For the first 10 years of his professional experience he worked with tools as a mechanic's helper, mechanic, and foreman. Then 22 years ago he switched to an office job, and aided by seven years of evening school at three different colleges, he advanced from machine design draftsman to machine design engineer to supervisor of machine design.

Mr. Willison first developed an interest in materials and passenger handling machinery while working in the aircraft manufacturing industry. This interest extends to his own activities, and he has traveled more than a million miles by every conceivable means—a large part of this in his own airplane. For the past several years he has been senior engineer for materials and passenger handling machinery and equipment for Smith, Hinchman & Grylls, Inc., architects and engineers, Detroit, Michigan.

Hydraulic Elevators and Modern Building Design

Ce exclusive

TRENDS IN BUILDING DESIGN during the past few years have created new problems for engineers, architects, and the elevator industry. Not many years ago, the architect or vertical transportation engineer merely selected the electric traction type elevator best suited to the building under consideration, and determined the number of elevators required in accordance with size and speed. Since elevator penthouses were accepted as a necessary if not decorative part of any building, this procedure conscientiously discharged the engineer-architect obligation to the client.

Current Problems

With the advent of modern building design, with its sleek, long, low lines uninterrupted by architectural or structural projections, the penthouse is in disfavor. One frequent solution to this problem has been the use of basement type electric machines. While this gets the job done for the architect and leaves him free from potential criticism from the larger suppliers of elevator equipment, it does not necessarily represent the best expenditure of the owner's vertical transportation dollar.

Actually the aesthetic consideration is only one of the problems. There are few items in the realm of factory or office building design where it is more important to leave the selection of the type of equipment to be used in the hands of engineering personnel qualified by both education and experience. They can make a decision between the several types of equipment available, unhampered by personal prejudice for or against any type of equipment or the incentive of a potential sale.

This is not intended to reflect upon the efficiency of any type of vertical transportation equipment—and most particularly not the traction type of electric elevator, for few items in our highly mechanicalized modern life have been developed to a similar degree of perfection. Nothing has yet been developed to approach it for vertical transportation in high buildings. It does not follow, however, that because electric elevators serve high buildings well and economically, they are the answer to all vertical transportation problems. The best approach to any pro-

lem is, of course, the use of a consultant familiar with all aspects of vertical transportation.

Cost is an important factor to all engineers and architects. The engineer selecting an elevator is no exception. To make an intelligent recommendation for vertical transportation in any building he must determine the specific requirements of the project, judge each type of equipment on its own merits and its suitability to the job at hand, and evaluate equipment costs against the service.

Design Considerations

Before attempting to make a study of elevator requirements for a building, the engineer must know:

¶ Total number of floors to be served.

¶ Total travel (distance) from the bottom terminal landing to the top terminal landing.

¶ Total area in square feet on each floor.

¶ Expected total number of people on each floor.

¶ Locations of all services, such as cafeterias.

¶ Building usage and the type of business to be carried on in the building, such as: department store, office building, school, factory, hospital.

After these data are established, five different types of vertical transportation equipment can be considered: (1) the escalator or electric stair, (2) gearless traction—variable voltage control electric elevators, (3) geared traction — variable voltage control electric elevators, (4) geared traction — a-c rheostat control electric elevators, and (5) electro-hydraulic elevators. The experienced engineer usually can eliminate one or two and sometimes three of these types by comparing the job at hand with previous projects. But there are always two, sometimes three, and occasionally four types of equipment that warrant investigation.

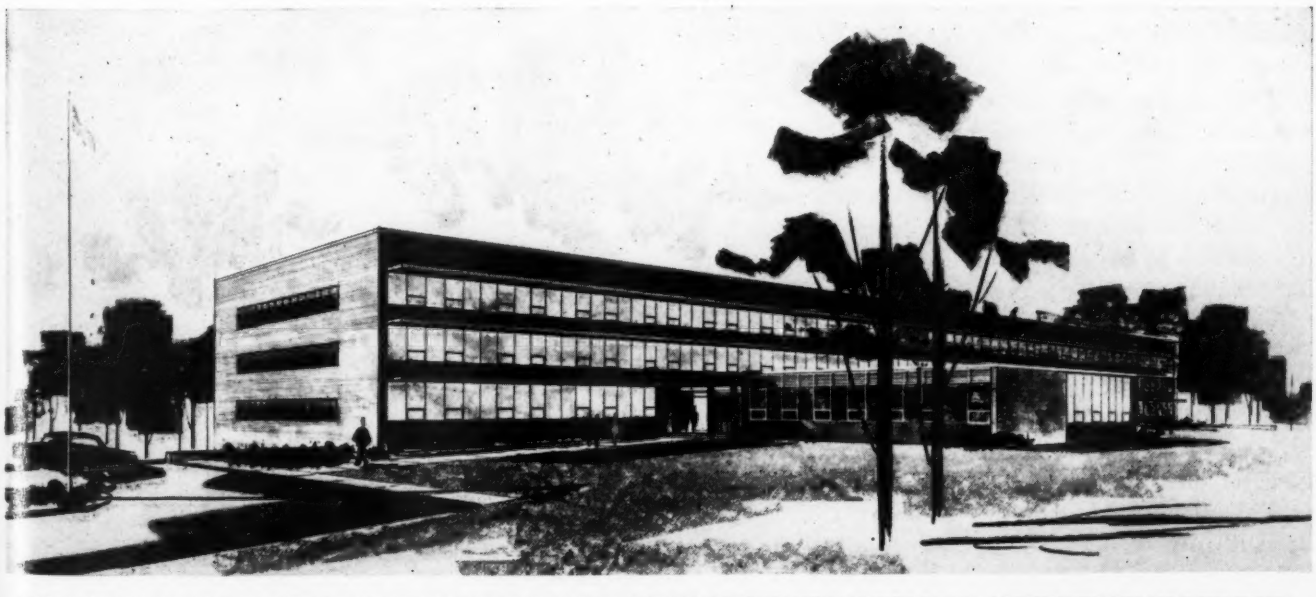
When the travel from the bottom terminal landing floor to the top terminal landing floor is more than sixty feet, hydraulic elevators probably will not be given any further consideration. Unless the building is a large department store, a very large office building, a railroad depot, air terminal, bus station, or other public building where a very large number of people are moving constantly from floor to floor, the escalator also will be eliminated. Past experience provides ample evidence that this type of equipment is not suited to such installations for cost reasons.

Sometimes, however, a study will indicate that it will take two or even three different types of vertical transportation to satisfy the requirements of a specific building. A system of this type might include escalators for the lower floors, high speed elevators for higher floors, and low speed elevators for freight.

Occasionally we may have to make a decision between a bank of hydraulic elevators and escalators, or we may find that a combination of hydraulic elevators and escalators will serve best. But it will be rare indeed when gearless traction and hydraulic elevators will be considered for the same job.

If we assume that the building under construction has less than sixty feet of elevator travel, the owner's best interests dictate that hydraulic elevators be given consideration. In general, the decision will be between geared traction variable voltage controlled electric elevators, geared traction a-c rheostat controlled electric elevators, and hydraulic elevators. Even where elevators are used in combination with escalators, any of these three types may be suitable.

The decision between geared traction variable voltage controlled and geared traction a-c rheostat controlled elevators often is decided by cost in buildings with less than sixty feet of travel. For this condition there is little opportunity to take advantage of the potentially higher speed of the variable voltage machine. This leaves the variable voltage machine with little more than its smoother acceleration and



HYDRAULIC ELEVATORS WERE INCORPORATED IN THE DESIGN OF THE NEW WHIRLPOOL ADMINISTRATION BUILDING.

deceleration and its ability to level more accurately to justify its greater cost.

In hospitals or other buildings where small wheeled carts are being moved onto and off the elevator, homes for the aged where elderly or crippled people are using the elevator, or any other building where accurate leveling and smooth starting and stopping are especially required, the a-c rheostat controlled elevator may not be suitable. The unfortunate fact is that the very institutions that require accurate leveling and smooth operation are most often the ones that can least afford the more expensive electric units needed for precision operation.

This brings us face to face with the question, "Why not hydraulic elevators?" There are five basic requirements to be considered in the selection:

¶ Suitability for the service requirements.
¶ Original cost.
¶ Expected life.
¶ Operation and maintenance cost.
¶ Safety.

Let us examine these requirements and compare the hydraulic elevator with other types, strictly from the owner's point of view and considering only buildings with less than sixty feet of total travel.

Suitability for the Service Requirements

The suitability of an elevator for specific service conditions is determined by its speed, smoothness of operation, leveling ability, method of operation, capacity, size of cab, type of cab, and type of doors.

Speed. Hydraulic elevators frequently are run at 125 feet per minute, and in some instances, large hydraulic freight elevators used in industrial production are operated successfully at a speed of 200 feet per minute. There is rarely any reason for exceeding these speeds in low rise buildings, and very frequently every reason for using elevators of less speed, regardless of the type of elevator. The question of higher horsepower requirements for hydraulic elevators of a given speed is greatly offset by the difference in the type of motor used, and the fact that hydraulic elevator motors run only when the elevator is moving in the up direction.

Smoothness of operation. Properly designed and installed hydraulic elevators are extremely smooth in operation. In fact, some of them are so smooth that it is difficult to be sure the car is in motion if you are not watching the car signaling devices.

Leveling ability. Hydraulic elevators level very accurately. This method of leveling can be so accurate that one of the large manufacturers of electric elevators sometimes uses it for leveling electric traction type elevators. The a-c rheostat controlled electric elevator does not level as well as the hydraulic elevator, and variable voltage elevators can compete with it only through the proper application of expensive leveling and releveling equipment.

Method of operation. By and large, any method of operation that can be used with electric elevators also can be used with hydraulic elevators. This includes: single automatic control, selective collective control or two-car two-button control, totally automatic multiple car systems, and the with or without elevator attendant feature. The principal difference is that the hydraulic elevator control system usually is much simpler in design.

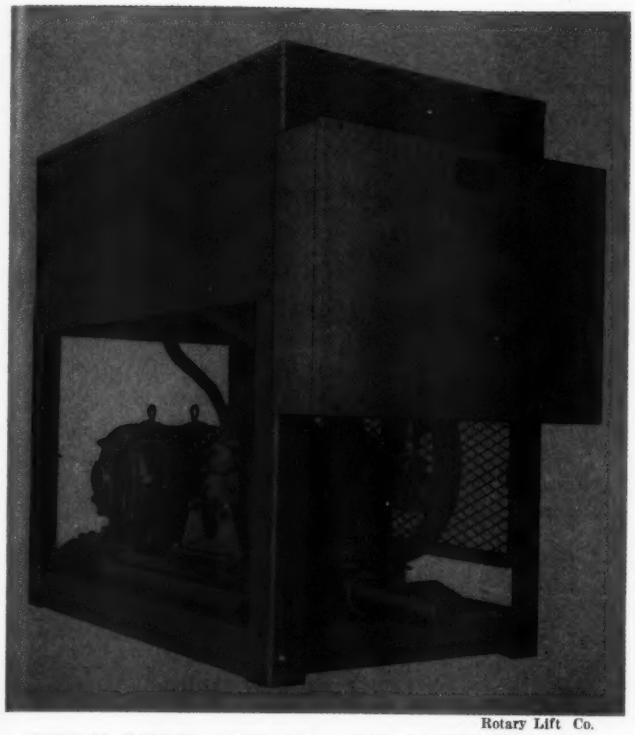
Capacity. Hydraulic elevators can be designed for any desired capacity.

Size of cab. In general, hydraulic elevators require less total floor space for a given size cab than electric elevators because it is not necessary to provide space for counterweights. However, very large industrial hydraulic freight elevators sometimes are counterweighted to offset the heavy duty cabs and loads and to get high speed with relatively low horsepower.

Type of cab and type of doors. Any cab and any car or hoistway door that can be used on electric elevators also can be used on hydraulic elevators.

It is easy to conclude from these characteristics

SELF-SERVICE HYDRAULIC ELEVATOR OF 1400-LB NET CAPACITY IN MODERN ARCHITECTURAL SURROUNDINGS.



Rotary Lift Co.

TYPICAL POWER UNIT FOR A HYDRAULIC ELEVATOR.

that hydraulic elevators are suitable for any application where the total travel is less than sixty feet, either passenger or freight, or a combination of both — commonly called a service elevator. The principal reason for not recommending hydraulic elevators for buildings with over sixty feet of total rise is that a larger size plunger is required, which in turn means more gallons of hydraulic oil must be handled for each foot of travel. This calls for a larger pump and larger motor. Everything considered, sixty feet is just a good place to stop.

Original Cost

For any given application, the gearless traction variable voltage controlled type elevator is the most expensive. It cannot be justified in low rise buildings.

Next in line is the geared traction variable voltage controlled elevator. This machine is used most frequently in medium rise buildings — sixty to one hundred and fifty feet of travel. If very smooth operation and accurate leveling are required in low rise buildings and electric elevators are insisted upon, there is no alternative but to use this equipment in spite of its comparatively high cost.

The cheapest of the electric elevators is the geared traction a-c rheostat controlled type. This unit does a very fine job within its own realm — medium rise apartment houses or, in some instances, office buildings with a comparatively light elevator load where very accurate leveling is not of major importance. It is no match for good hydraulic equipment for either smoothness of operation or accurate leveling, in spite of its somewhat higher cost.

The blunt fact of elevator cost is that the best in hydraulic elevators, which is equal to the best in elevator equipment regardless of cost insofar as low rise buildings are concerned, can be purchased for less than the cheapest type of electric elevator. Add the fact that a considerable amount of money can be saved by the elimination of the penthouse, and we have a good case for the hydraulic elevator.

Expected Life

Elevators are inherently machines with a very long service life. Almost all of them are very well built, and most of them are well maintained by qualified mechanics. This is partly due to the fact that most operating elevators are inspected periodically by safety inspectors, and in many areas elevator mechanics are required to have a license.

Properly designed and installed hydraulic elevators compare favorably with their long life counterparts, the electric elevators. This is especially true if an outside casing is used and the cylinder and piping below ground level are protected properly.

Operation and Maintenance Cost

The point upon which the hydraulic elevator will probably endear itself to the owner most is its operating and maintenance cost. Actually, if you will compare the cost of operating any other type of human transportation, with the one exception of the escalator (and be sure to include the very well known cost of operating your own family car), with the cost of operating any elevator, in terms of passenger miles, you will find the elevator a very inexpensive servant. Yet the operating and maintenance cost of the hydraulic elevator is only from fifty to seventy per cent of the cost of operating and maintaining an electric elevator for the same installation.

Safety

Hydraulic elevators are the safest of all types of elevators. Even the standard elevator safeties required by law on all types of electric elevators generally are not required on passenger hydraulic elevators. There is considerable difference of opinion among elevator engineers as to the necessity of safeties on hydraulic passenger elevators, and there is some good reasoning on each side of the discussion. However, very good safeties especially designed for hydraulic elevators are available, and most standard governor controlled safeties work equally well on both hydraulic and electric elevators.

Since there is little chance for the hydraulic elevator to make a free fall, and since safeties can be added if it is felt they are required, it must be concluded that hydraulic elevators can be made as safe or safer than it is possible to make any electric elevator. Incidentally, elevators of all types, hydraulic or electric, are one of the safest means of transportation known to mankind. ▲▲

Consulting Engineers Meet in St. Louis

STAFF REPORT

ASSOCIATIONS REPRESENTED

Consulting Engineers Association of California
William W. Moore — Pecos H. Calahan

Chicago Association of Consulting Engineers
Edward J. Wolff — Leroy H. Nettnin

Colorado Association of Consulting Engineers
K. J. Murray

Gulf Institute of Consulting Engineers
B. M. Dornblatt

Intermountain Institute of Consulting Engineers
George W. Poulsen

Minnesota Association of Consulting Engineers
A. L. Sanford — T. E. Roche

Missouri Association of Consulting Engineers
Joseph Williamson, Jr.

New York Association of Consulting Engineers
John K. M. Pryke

Consulting Engineers of Upstate New York
Howard F. Eckerlin

Consulting Engineers Association of Oklahoma
C. C. Pate

A GROUP OF APPROXIMATELY 90 consulting engineers met in St. Louis, October 28-29 to discuss the formation of a National Association of Consulting Engineers. These men represented 10 city, state, or regional Associations of Consulting Engineers. Several observers representing other organizations or areas in which it is proposed that regional associations be formed also were present. The Missouri Association of Consulting Engineers and the Consulting Engineers Association of Oklahoma were hosts for the meeting. Joseph Williamson, Jr., of St. Louis, was elected Chairman. Mr. John Harvie, also of St. Louis, was appointed Secretary.

CE exclusive

It was agreed that the first day of the meeting would be devoted to reports from the representatives of the various societies so that all present could get a good idea of the objectives and the accomplishments of these groups in their own regions or states.

Oklahoma Association

C. C. Pate, President of the Consulting Engineers Association of Oklahoma told the group that their association started from an informal gathering of

THE FRIDAY NIGHT DINNER BROUGHT TOGETHER CONSULTING ENGINEERS (AND THEIR WIVES) REPRESENTING THE TEN ACTIVE STATE ASSOCIATIONS.

consultants, in Tulsa, in April 1953. A misunderstanding, due primarily to the lack of definition of responsibility of each profession, then existed between Oklahoma architects and engineers. The architects had a strong organization; the consulting engineers had none. The consultants found that the Oklahoma Society of Professional Engineers was not sufficiently sympathetic to their plight and would take no constructive action. It is understandable that OSPE was not vitally interested in problems involving only 5 percent of its membership. In view of this, a group of 15 consulting engineers adopted a constitution, elected officers, and formed the Consulting Engineers Association of Oklahoma.

During the past year the Association has endeavored to promote reforms within the profession and to establish its own organization on a firm footing.

Pate expressed the hope that this group assembled in St. Louis might form an association of the various groups represented and engage a paid staff devoted to promoting the profession of consulting engineering and solving the problems facing the various groups. He expressed the hope that the State Associations could as a body arrange to write a constitution, bylaws, and a statement of aims for a National Association within the following three to six months.

In the discussion following Mr. Pate's explanation of the Oklahoma Association, he was asked why there was so little help from the Oklahoma Society of Professional Engineers prior to the formation of the Association. An Oklahoma representative explained that their group of consultants had been too small to have any influence upon the activities of the Oklahoma Society of Professional Engineers, but that since the development of their Association, they had been able to cooperate very closely, and relations with OSPE had greatly improved. It was pointed out that in Oklahoma all members of the consulting group are encouraged to join OSPE.

Gulf Institute of Consulting Engineers

B. M. Dornblatt, past president of the Gulf Institute, then took the floor to tell about his organization and its activities. It was organized in 1950, again because of problems in relations with architects. The constitution of the Institute is based to a great extent on the constitution of the American Institute of Consulting Engineers. This was done with the thought that the Institute might at some time affiliate with the American Institute and become a chapter of it. Mr. Dornblatt pointed out that there is no Louisiana Society of Professional Engineers and that they therefore were not faced with the question of whether to act as a part of a State Society or to set themselves up separately. One of the principal purposes of their organization is to help educate all clients as to the services that can be rendered by a consulting engineer. The group also has prepared standard minimum recommended fee schedules, in cooperation with AIA, as a guide for all engineering work with architects. They have also prepared a fee schedule for engineering work directly for owners.

One of the problems recently faced by the consulting engineers in Louisiana is in connection with industries coming into the state and bringing their own engineering organizations. These out-of-state engineering firms are not too familiar with local conditions and have made a great many errors. This applies to the work of staff engineers more particularly than to outside consultants. The Institute is preparing a list of leading consulting firms in the state to distribute to industry that will point out the advantages of using local consulting engineers.

There has also been some trouble in Louisiana in connection with the Federal Wage and Hour Laws. The problem involves the payment of overtime to professional engineers employed by consultants. It looked as though the Wage and Hour Administration was going to crack down hard on consultants in Louisiana. This problem was taken before the American Society of Civil Engineers and the American Institute of Consulting Engineers, but the consultants in Louisiana could get no cooperation. Through the Gulf Institute, money was raised to fight the test case as far as the Supreme Court. Currently the Federal Government is not pushing the case.

Mr. A. C. Kirkwood, of Kansas City, then declared

RAYMOND TUCKER, P.E., MAYOR OF ST. LOUIS, INVITES THE GROUP TO LOCATE HEADQUARTERS THERE IF THEY SHOULD FORM A NATIONAL ASSOCIATION.

that a somewhat similar case was now pending before the United States Supreme Court involving the firm of Kenneth R. Brown, in Iowa. The National Society of Professional Engineers has intervened with the consulting firm's permission. The National Society also is acting in the interest of several other consulting engineering firms involved in somewhat similar suits, and Mr. Kirkwood further stated that the National Society proposes to continue to defend the interest of the consulting profession whenever and wherever the occasion arises.

Missouri Association

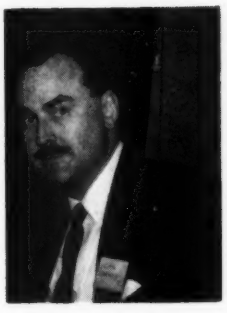
Joe Williamson explained that the Missouri Association is extremely new, having just been organized a few months ago. The objective of the organization is to develop consulting engineering as a profession, promote high standards of professional performance, promulgate appropriate policies of the Missouri Society of Professional Engineers affecting the consulting engineer and his client, and develop inter-professional practice for the benefit of the consulting engineer, the architect, and the general public. They also intend to provide information to communities, state, and nation on the services of consulting engineers. This organization is committed to affiliation with MSPE through dual membership requirements. The Missouri Association of Consulting Engineers works closely with the Missouri Society of Professional Engineers and supports wholeheartedly the state society program but expects to carry the burden of its own special problems involving consultants.

Williamson pointed out that the Missouri Association felt that a National Association of Consulting Engineers, if formed, should be a coordinating body rather than a governing body. It should serve usefully as a clearing house for all of the self-governing state associations of consulting engineers.

Kirkwood, of Kansas City, then explained the posi-

LESTER BOSCH TELLS HOW ENGINEERS IN OHIO ARE REPRESENTED BY COUNCILS IN THE MAJOR CITIES.

RESOLUTION OF THE STEERING COMMITTEE



The following resolution was presented to the group, passed unanimously by the representatives of the ten associations, and put into effect by electing a slate of interim officers headed by John K. M. Pryke, (right) President of the New York Association of Consulting Engineers.

1. That consideration be given to the formation of a National Federation to represent the various consulting engineers associations who are present at this meeting and others of similar type who may wish to join such a Federation in the future.

2. That the representatives present vote on this first recommendation. Each established association present to be limited to one vote.

3. That subject to this vote being in the affirmative, majority interim officers comprising chairman, vice-chairman, secretary, and treasurer be elected.

4. That the officers shall produce a draft of a constitution and by-laws, which shall be circulated to all associations for consideration and comment within the next ninety days. Within a further ninety days ratification of the finally agreed constitution and by-laws shall be requested. In the event of such ratification by a majority of the associations represented at the present meeting, a formal meeting shall be called to which each association shall send a voting delegate. At this meeting the National Federation shall be officially set up, its initial slate of officers be elected, and its modus operandi be initiated.

tion the Kansas City consulting engineers with relation to the Missouri Association. The Kansas City group has agreed on the broad principle that the consulting fraternity must have representation. They established this at an earlier meeting, a meeting in which the aims and objectives of the Missouri Association of Consulting Engineers was explained to them. However, it appeared to be the feeling of the majority of the consultants in the Kansas City area that there might well be a better opportunity to accomplish the desired ends by working through the various State Societies of Professional Engineers and the National Society of Professional Engineers. Mr. Kirkwood is a director of the National Society of Professional Engineers and is on their Engineering Practices Committee. He took part in the Memphis meeting of NSPE in which it has been decided to place considerably more emphasis on functional groups within the Society.

It became clear in the following discussion that so far as Missouri is concerned, the St. Louis group feels that the needs of consulting engineers can best be served by a separate association, while Mr. Kirkwood, representing the Kansas City group, feels that the answer is to work within the new functional framework of the National Society of Professional Engineers and the various State Societies making up that organization.

Mr. Williamson pointed out that the Missouri Association of Consulting Engineers was most anxious to have the Kansas City consultants join their organization and that the presently elected officers, all of whom are from St. Louis, are committed to resign in appropriate number at any time in favor of Kansas City, should consultants in that area affiliate.

Luncheon

The principal speaker at the luncheon was the Hon. Raymond R. Tucker, Mayor of the City of St. Louis. Mr. Tucker, being an engineer himself, was able to recognize the importance of this meeting, and he dwelt upon the need for municipalities and other governing bodies to make use of the consulting engineer's services. The mayor also invited the organization to place its headquarters in St. Louis when it is formed.

Afternoon Session

Immediately after the luncheon the group returned to the meeting room in the Jefferson Hotel, and a comittee was appointed consisting of Pecos Calahan, of California; Houston Smith, of Missouri; John K. M. Pryke, of New York; and T. E. Roche, of Minnesota. This committee was assigned the task of defining, in the form of a resolution, the desires of the group, this resolution to be presented the next day for modification and then rejection or approval. The chairman reported that Mr. Roche, of Minnesota, had prepared a summary of the constitution and by-laws of the various state and regional associations and that copies of these would be available to all interested parties*.

Ohio Consulting Groups

Mr. Lester Bosch, of Cincinnati, explained that there is currently no independent association of consulting engineers in Ohio. On the other hand, the Ohio Society of Professional Engineers is exceptionally active. Also, the large cities in Ohio have engineering societies and councils that unify the activities of the various engineering groups in their cities. The consulting engineers in Cincinnati gave thought as to whether they should set up an independent group or operate through OSPE. The same was true in Cleveland, Dayton, and Columbus. Mr. Bosch explained that in Ohio they have an organization that is active,

*CONSULTING ENGINEER will publish, in January, a copy of this summary showing the organization and principal features of the constitution and by-laws of each State Association of Consulting Engineers.

growing, and taking care of all the professional engineer's needs, so from the consulting engineer's point of view, there is just the one, hardboiled, business aspect not currently covered.

Mr. Bosch then turned the floor over to Mr. Ruehleman who explained the operation of the private practice functional group of NSPE in Ohio. Mr. Ruehleman stated that there were several drawbacks to their current arrangement because of the by-laws of the OSPE as they now stand. For example, there is no way to restrict membership in the Private Practice Functional Group under the by-laws of the Ohio Society of Professional Engineers. Also, no dues can be collected by the functional group. There can be voluntary contributions but no dues as such. Furthermore, the administration of any funds that are collected must be by approval of the Ohio Society Executive Board. In other words, the functional groups cannot administer their funds as they see fit. However, NSPE recently has authorized the changing of by-laws in order to remove these difficulties.

Colorado Association of Consulting Engineers

Mr. K. J. Murray reported on the Association of Consulting Engineers of Colorado. This is a very new organization, just two months old at the time of this meeting. The organization grew out of a two year old group of structural engineers who felt they were accomplishing so much that they invited the Mechanicals and Electricals to join with them. The principal purpose of the organization at the present time is to deal with problems involved in relations with architects, but the aims will be expanded as time goes on. But recently organized, the organization had no results to report.

Upstate New York

The Consulting Engineers Association of Upstate New York, as represented by Mr. Howard F. Eckerlin, president, has been in operation for approximately a year and a half. They patterned their constitution after that of the New York Association of Consulting Engineers, which is limited to Metropolitan New York. They have been working on the problem of standardizing fee schedules and have surveyed going rates among all of the members. They also have investigated the question of liability insurance but thus far have been unable to find and recommend a suitable insuring body. Currently there are 12 members in this organization but there is a waiting list. The current members feel that they would like to get the fee schedules completed before opening up the membership.

There is no connection between the Consulting Engineers Association of Upstate New York and the New York State Society of Professional Engineers except a considerable overlap in membership. Mr. Eckerlin stated that before the organization of their Association, many of their members had tried to get help on an individual basis from the New York Society of Professional Engineers, but that they had not been successful and assumed the Society was uninterested.

Mr. Kirkwood, of Kansas City, asked Mr. Eckerlin why the Association of Upstate New York had used the term "licensed professional engineers" in their constitution in defining their membership. Mr. Kirkwood asked if this implied that the engineers not in private practice were not professional. This brought about discussion as to the meaning of the terms "consulting engineer," "professional engineer," and "professional engineer in private practice." It seemed to be the general feeling of the group that a professional engineer is any engineer registered in his state, and that it would be better for consulting engineering organizations to use the term "consulting engineer" or "professional engineer in private practice" to identify their special field.

Calif. Civil Engineers and Surveyors

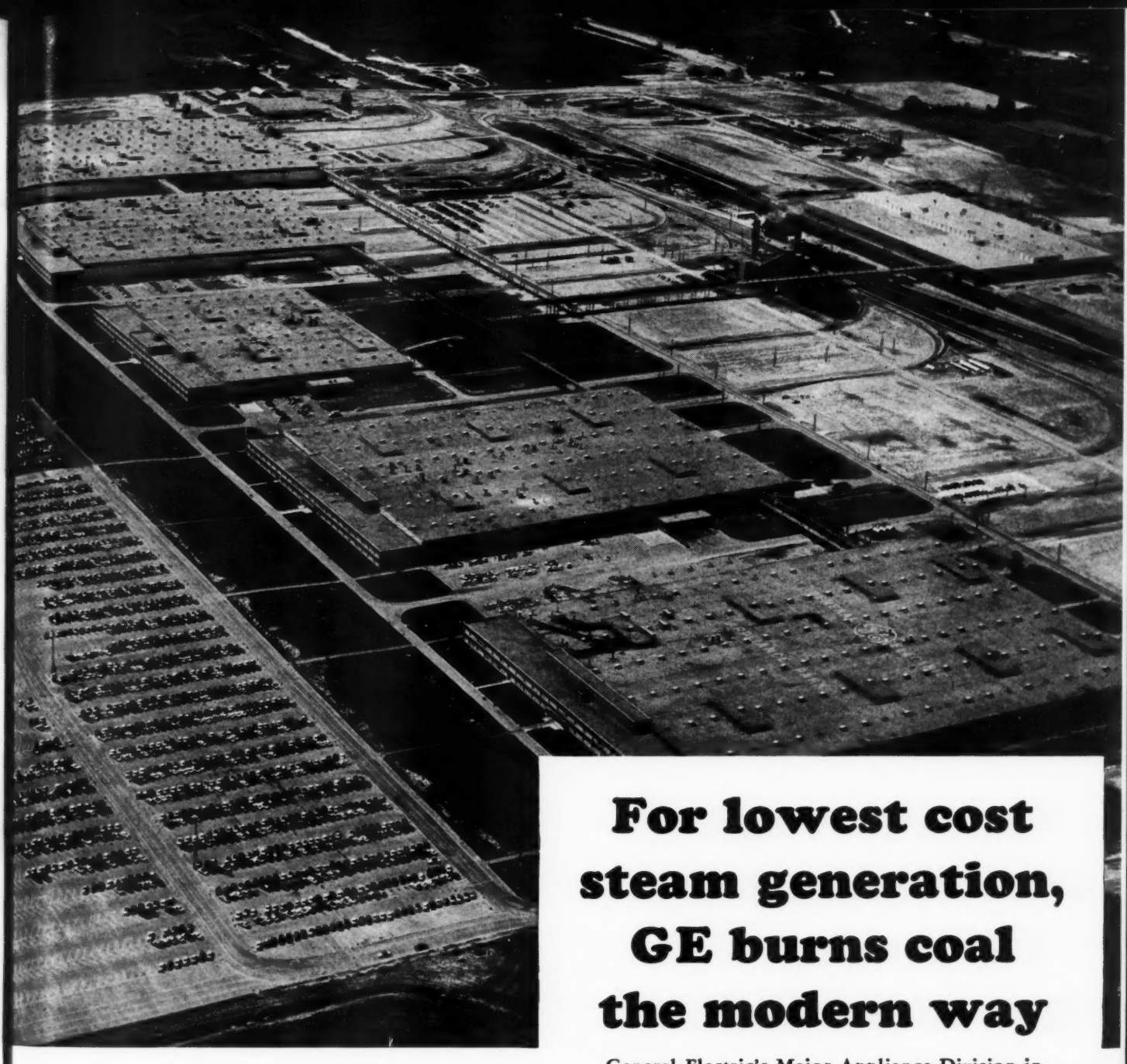
William A. White, newly appointed Executive Secretary of the California Council of Civil Engineers and Land Surveyors, explained that their group was formed largely because of the pressure of labor unions to organize their field men. About two-thirds of their members are civil engineers and the remainder licensed land surveyors. This group and the Consulting Engineers Association of California are separate and distinct groups, and both are distinct from the Structural Engineers of California.

American Institute of Consulting Engineers

Mr. Edward Anson attended the meeting as an unofficial observer of the American Institute of Consulting Engineers. He gave a brief history of that organization. High ethical conduct and membership in one or more of the Founder Societies are basic requirements for membership in the Institute. The Institute now has around 250 members all across the country. Mr. Anson said that while the Institute had been known as a sort of "New York Luncheon Club," it was not that at all. About 40 percent of the whole membership is from New York City, but this is merely because there are a great many outstanding consultants in that area. The Institute currently has no local chapters, but this is "only as of this minute."

When asked if the American Institute of Consulting Engineers was prepared at this time to fill the need for which the group was gathered in St. Louis, Mr. Anson answered that there is a difference of opinion within the Institute. He said that the American Institute of Consulting Engineers is an organization of *outstanding* consulting engineers. A man has to be 35 years of age to be a member, and there are many young engineers doing quite a practice that have not attained that age.

"In that respect," Mr. Anson continued, "we are trying to find out where we belong. The Institute was started in 1910. It was an organization to represent



For lowest cost steam generation, GE burns coal the modern way

General Electric's Major Appliance Division in Louisville, Ky., has five product manufacturing buildings, a warehouse and service buildings—over 4 million sq. ft. under roof. To generate all steam necessary for process work and heating requirements of this vast area, GE's power plant burns coal the modern way. Coal was chosen for two reasons. One, a careful fuel cost study disclosed that, on a straight economic basis, coal would give GE the lowest cost steam generation of all fuels. Second, availability of supply was considered and again coal won over other fuels. In addition, full mechanization of GE's power plant has facilitated all details of coal handling and ash removal while completely eliminating any possibility of air pollution.

For further information or additional case histories showing how other plants have saved money burning coal, write to the address below.

NATIONAL COAL ASSOCIATION
Southern Building, Washington 5, D. C.

Note to Consulting Engineers:

Many companies planning a new power plant, or the remodeling of a present one, consult an engineering firm on its design and construction. When you have such a project, our Engineering Department will be glad to assist you in your fuel cost survey with any coal information you may require. In most cases, for the reasons listed below, the use of coal results in substantial savings in increased efficiency and fuel economy through the years.

facts you should know about coal

In most industrial areas, bituminous coal is the lowest-cost fuel available. • Up-to-date coal burning equipment can give you 10% to 40% more steam per dollar. • Automatic coal and ash handling systems can cut your labor cost to a minimum. Coal is the safest fuel to store and use. • No smoke or dust problems when coal is burned with modern equipment. • Between America's vast coal reserves and mechanized coal production methods, you can count on coal being plentiful and its price remaining stable.

the consulting engineers across the country. Maybe it has failed. Maybe it hasn't failed. Maybe it does represent the people who have attained a higher place in the profession. When I say higher place, I don't mean higher paid but that they are older and have broader experience. You see, we recognize there is a gap that isn't filled—people in private practice, particularly younger men, that this Institute doesn't cover. So my personal opinion is that there is a need for state organizations as represented here today. We do feel, however, that the Institute can serve a very useful purpose in guiding or helping some of the other organizations that are newer because of the length of time this Institute has been operating across the country."

Minnesota Association

T. E. Roche, of Minneapolis, reported on the activities of the Minnesota Association. According to Mr. Roche, the reason for the formation of the Minnesota Association was the plague of "free engineering." The Minnesota Association has met with electrical contractors and with general contractors and pointed out to them that contractors were to build the jobs and make the installations; engineers were to design, specify, and supervise construction. The contractors acknowledged this but stated that the consulting engineers in many instances were not drawing plans and writing specifications that could be followed. Therefore, the contractors had to do much of the engineering work themselves.

Facing this accusation squarely, the Minnesota Association began a program to improve plans and specifications so that they might satisfy the needs of contractors. Their efforts were successful. The group then met with manufacturers' salesmen and achieved the same very favorable results. Many salesmen who were doing engineering work for architects and customers ceased doing that type of work and began cooperating with the consulting engineers of Minnesota.

The Minnesota Association has offered assistance to state and local organizations to help them make better codes and clearer interpretations. The group currently is working on fee schedules.

Mr. Roche said that approximately 40 percent of their association membership are also members of the Minnesota Society of Professional Engineers. They are cooperating excellently with the State Society. However, in Minnesota the consulting engineers feel that their problems can best be solved within their own organization. MSPE is cooperating with the Association on all problems pertaining to legislation and registration.

Chicago Association of Consulting Engineers

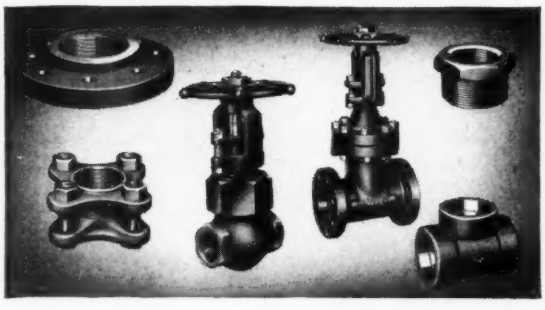
Edward J. Wolff, president of the Chicago Association explained that their group was founded in 1921. Currently they have 35 members. Recently, the Chicago Association has been studying relations with contractors. A committee has been working on a code of trade practices. This group has met with the four trade groups, the plumbers, steam fitters, ventilating contractors, and electrical contractors, and are now meeting with architects and the manufacturers of the major component parts that go into projects. During the past 2½ years there have been meetings practically every week with the four trade groups. Here, again, the various contractors were complaining that engineering drawings prepared by consultants and the specifications accompanying them were not sufficiently complete. A document has been drawn up known as a "Code for Preparation of Engineering Drawings for Mechanical and Electrical Equipment in Buildings." This settled upon methods in which drawings and specifications were to be made to satisfy the contractors. In return for this, the contractors have generally agreed to leave engineering work to the consultants. In substance, this committee meeting with the trade groups gave and took, and then gave and took some more, until they finally arrived at a satisfactory meeting of the minds. The last few conferences have been with the local chapter of the American Institute of Architects, making a start toward agreements in this field.

New York Association of Consulting Engineers

The history and the recent activities of the New York Association of Consulting Engineers were explained by Mr. John K. M. Pryke, President of the Association. This association was formed in 1923. It has had a long and active history. In the beginning it was formed primarily to safeguard the interests of consulting engineers engaged in design of mechanical, electrical, and sanitary installations for buildings and also to attempt some standardization of fees. In the very early days of the organization, a schedule of fees was set up and adopted, and a basic contract for services was drawn up. In 1953, the original form of contract was replaced by the new form. There are currently five forms of architect-engineer contracts. These forms are based on various fee structures. These were worked out in conjunction with the New York Chapter of the American Institute of Architects. The constitution and by-laws, codes of ethics, and fee schedules of the New York Association are now printed and bound in book form, and these books have been distributed to every member of the AIA chapters in the greater New York area.

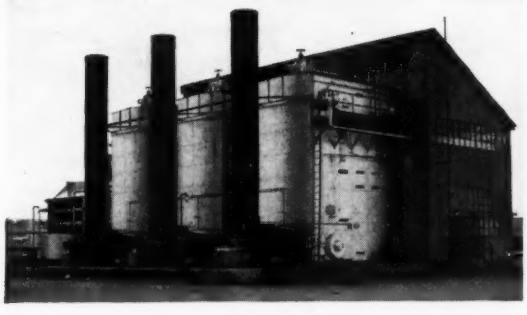
The New York Association has 12 active working committees. These include a Fees and Contract Committee, a Committee on Adequate Wiring, a Structural Code Committee, a Committee on Standard General Conditions, and an Architect's Credit Rating Committee. The Association has worked to see that satisfactory contracts are written in connection with all city work so that there is no shuffling around by an architect to get the cheapest fee from his sub-

Designed for today's *Tough* service demands



DROP FORGED VALVES AND FITTINGS FOR TOUGHNESS AND TROUBLE-FREE SERVICE

Drop forged from carbon and alloy steels, Vogt valves, fittings and flanges will safely handle liquids and gases at high pressures and high temperatures in power plants, chemical plants, petroleum refineries, etc. The complete line includes flanged, screwed and socket weld end globe, gate and check valves—ells, tees, and crosses—couplings—bushings—plugs—unions—flanges and flange unions—and welding heads.

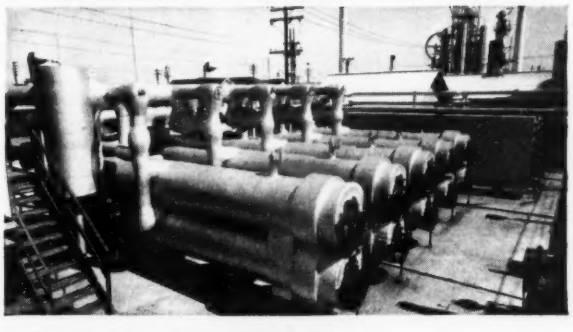


MODERN STEAM GENERATORS

Vogt steam generators are designed to give maximum rating in a minimum of space, with high efficiency and low maintenance expense. Bent tube types and straight tube, forged steel sectional header types to burn solid, liquid or gaseous fuels meet every power, process or heating requirement.

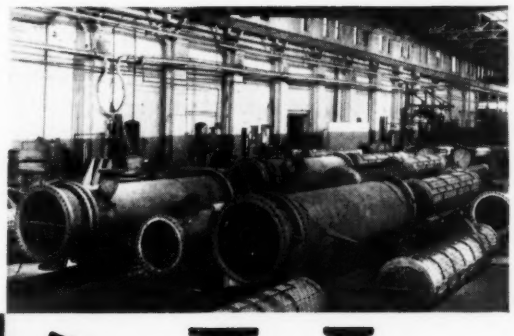
PROCESS EQUIPMENT FOR EVERY SERVICE

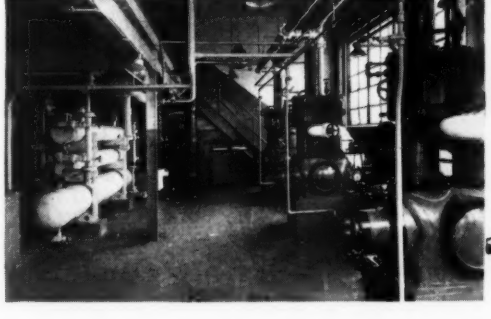
Vogt constructs process equipment in wide variety to all Codes. Stills and towers, oil chillers, crystallizers, heat exchangers, molding machines, etc., serve in the manufacture of oils, greases, 100 octane gasoline, synthetic rubber, chemicals and related products around the world.



SPECIAL MATERIALS COMBAT CORROSION AND PRODUCT CONTAMINATION

Our modern shops produce a wide variety of equipment from special metals and alloys to fight corrosion and product discoloration or contamination. Fabrication procedures insure that corrosion resistant properties of welds will match that of the materials used to construct the equipment.





MORE REFRIGERATION TONNAGE AT LESS COST

More than 70 years of engineering and manufacturing experience is incorporated in Vogt refrigerating and ice making equipment. Absorption Systems, Compression Systems, and Tube-Ice Machines in a wide range of capacities serve industrial and processing plants, and institutions, here and abroad.

Vogt

PRODUCTS

FOR REFINERIES, CHEMICAL PLANTS POWER PLANTS AND PROCESS INDUSTRIES

HENRY VOGT MACHINE CO.
LOUISVILLE 10, KY.

Address inquiries to Dept. 24-GCE
SALES OFFICES: New York, Philadelphia, Cincinnati, Chicago, Cleveland, St. Louis, Dallas, Charleston, W. Va., San Francisco

contractor engineers. The group also has worked with the City of New York in shaping city codes and revising obsolete codes.

The Association has been successful in negotiating with Lloyds of London for a Group Errors and Omissions Policy and now have produced a standard form. There are two forms, one applying to structural engineers and one applying to mechanical and electrical. They have succeeded in getting a 20 percent reduction in annual premiums.

The New York Association also has formed an employer's pool for employees. This is designed to eliminate the hiring and firing of employees resulting from peaks and valleys of work. The general distribution of work throughout the Association seems to be pretty even. They have worked out a system of pooling so that when any firm falls slack, they loan their extra employees to the other Association members. The employee so loaned remains on his original employer's payroll and the original employer is entitled to charge the temporary employer a 25 percent handling charge on the employee's salary. The Association charges $10.00 for its services for each exchange.

So far as relations with the New York Society of Professional Engineers is concerned, the principal cooperative effort in the past was in connection with legislation designed to permit incorporated consulting firms to work in New York. Two years ago the New York Association combined with the New York Society of Professional Engineers to combat the bill, and they succeeded. Last year the same bill came up in a slightly different form, and the Association again approached NYSPE. The New York Society split on the bill, having a considerable proportion of their membership in favor of the new version. This meant that the New York Association could not rely on NYSPE to really safeguard the interest of independent consulting engineers, and the Association finally joined with other groups who were interested and formed a committee that was successful in combatting the legislation.

A question then was brought up from the floor as to the New York Association's success in discouraging "free engineering services" by manufacturing firms, particularly those in the air conditioning equipment business. Mr. Pryke stated that within their own area he did not recollect a major job using newer types of high pressure air conditioners that had not been handled by a consulting engineer. He said that he knew a great deal of engineering work was being done by some of the manufacturers outside of the New York area but that they simply do not do engineering on projects within the area.

Dinner Speakers

The principal speaker at the Friday night dinner meeting was Hunter Hughes, Editor of CONSULTING ENGINEER. He gave a historical summary of engineering organizations in this country, emphasizing their efforts toward unity and their handling of the particular problems of engineers in private practice. Hughes pointed out that the Founder Societies were very much interested in the problems of consulting engineers but that each functioned in a particular branch of engineering, thereby separating rather than unifying engineers in private practice. He said that the American Institute of Consulting Engineers appeared to be a logical organization to deal with the problems of consultants but that they did not seem interested in forming active chapters on a state by state basis. The National Society of Professional Engineers comes closest to being the group both willing and able to handle the affairs of engineers in private practice, but their Functional Group concept came with too little too late.

Hughes recommended that if this group formed a National Association, arrangements be made to finance it so that it could spend in the neighborhood of $250,000 a year for staff, public relations, publicity, advertising, and ethical types of lobbying. If one thousand consulting firms belonged to this organization, this would mean dues of $250.00 per firm.

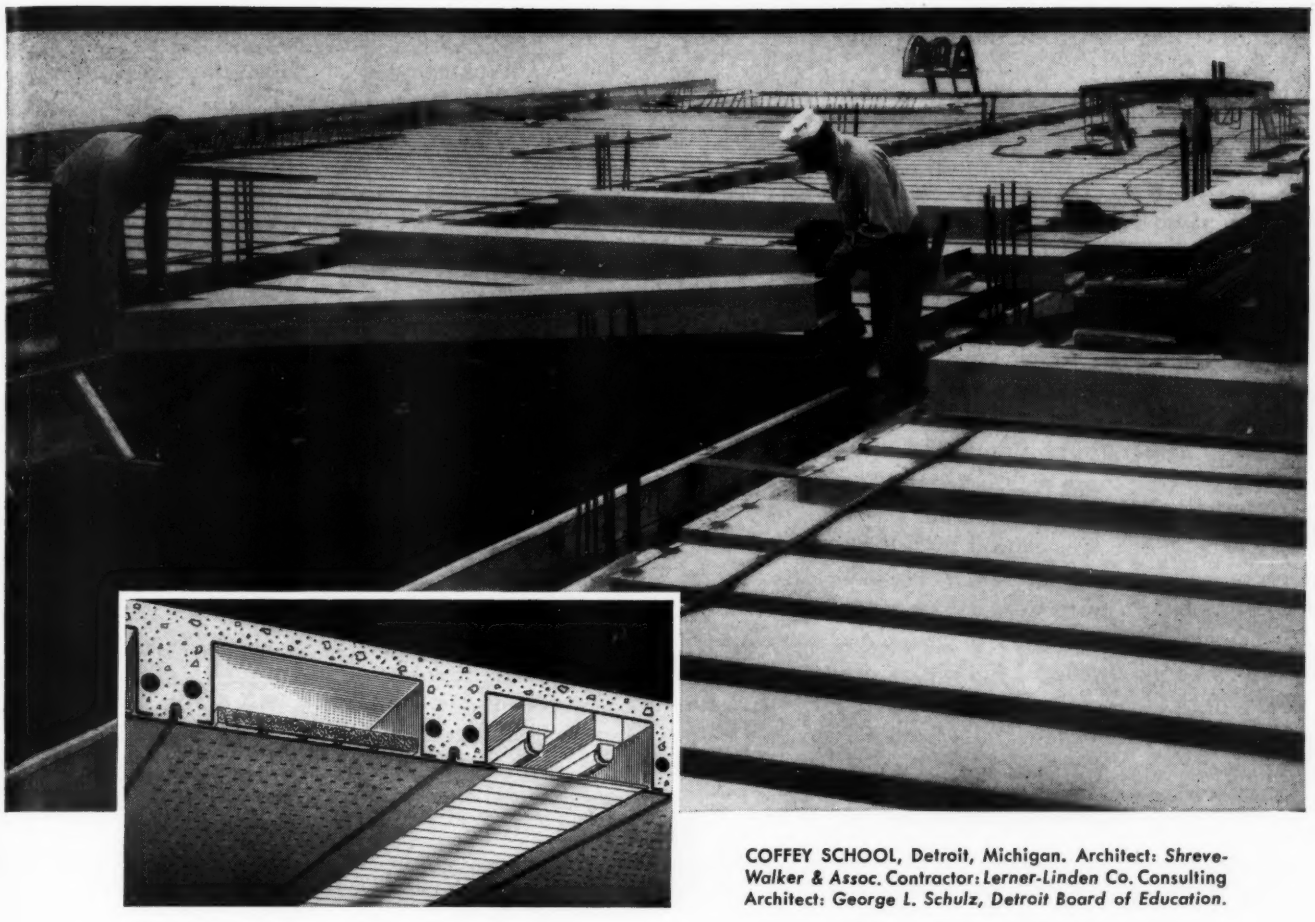
Saturday Morning Session

On Saturday morning, Joe Williamson called the meeting to order and introduced George W. Poulsan, President of the Intermountain Institute of Consulting Engineers. Poulsan explained that in Utah there is an excellent Engineering Council, active chapters of the various Founder Societies, and an active Utah Society of Professional Engineers. However, many of the engineers in these organizations are sales engineers, many are contractors, and many are employed by industry. Mr. Poulsan stated that the consultants in Utah work within these groups but that they do not expect them to fight the consultant's battle for him.

Consulting Engineers Association of California

Pecos Calahan, Executive Secretary of the California Association described the history and organizational structure of his Association. This is a large and old organization going back to about 1916. According to Calahan, the unions really precipitated the Consulting Engineers Association in the northern part of the state, while in southern California the principal problems were in dealing with architects. The organization in its current form was really started in 1941. It was not, however, until 1951 that the northern and southern groups finally got together as one organization. Currently, the Association maintains offices in San Francisco, and is extremely active in handling the affairs of consulting engineers throughout the state.

Dues of each member in the California Association are based on net personal income from consulting practice of the previous year. Dues for the members in the lowest income bracket are $60.00 annually, and



COFFEY SCHOOL, Detroit, Michigan. Architect: *Shreve-Walker & Assoc.* Contractor: *Lerner-Linden Co.* Consulting Architect: *George L. Schulz, Detroit Board of Education.*

NEW WAY TO BUILD SCHOOLS . . . FASTER!

Fenestra TROFFER-ACOUSTICAL Panels combine concrete joist forms, built-in acoustical ceilings and recessed lighting troffers

Now you can have better-looking, better-lighted classrooms with fireproof construction and save both time and money. The NEW Fenestra* Troffer-Acoustical Panels—TAC Panels, for short—are designed to wrap up 3 expensive building materials in *one* economical, quickly erected building unit. They permit you to have acoustical treatment and recessed lighting—features that usually require extra time and labor—*built right in the structure itself!*

Here's how it works. As you can see in the photo above, the TAC Panels—either for troffer lighting or metal pan acoustical ceilings—are long-span units. Placed in position on the formwork for the main beams, they provide the forms for the concrete joists and floor slabs. Temporary supports at mid-span while pouring concrete are *all* the additional shoring required. After the concrete is cured, the panels *stay in place* and function as the finished ceiling—complete with built-in acoustical treatment—and as lighting troffers. Only painting and lighting fixture installation are needed to complete the room.

And TAC Panel ceilings are easier to maintain year after year. They can be washed or repainted as often as needed, without affecting the acoustical treatment. There is no hanging ceiling or "stuck on" acoustical material to be damaged or replaced.

Even if your plans are now on the drawing board, they can easily be adapted to use Fenestra TAC Panels. Ask your architect to investigate this new building method, now, or write for a copy of *Fenestra TAC Panel System* that gives you complete details. Detroit Steel Products Co., Dept. CE-12, 3443 Griffin St., Detroit 11, Michigan. *Trademark

Fenestra TAC **TROFFER-ACOUSTICAL BUILDING PANELS**

Patents applied for

Architectural, Residential and Industrial Windows • Metal Building Panels
Electrifloor† • Roof Deck • Hollow Metal Swing and Slide Doors

†®

this goes up to $500.00 annually for personal incomes of over $60,000.

Currently, the organization is maintaining a close contact with government agencies and points out to them the advantages of using the facilities of private engineering offices. It represents the profession before public bodies. It makes a united effort to restrain adverse legislation and promote legislation that is favorable. It presents a united front in matters of union demands, law suits, and wherever a problem arises that has a bearing on the rights or welfare of the membership as a whole.

The Association also is carrying advertisements in the *Wall Street Journal* and in the *Western City*.

Then, Mr. William W. Moore, President of the California Association continued an explanation of the operation of the Association by telling of its various accomplishments. A pamphlet has been prepared to aid one of the committees of the Highway Research Board. Considerable work has been done on contract arrangements and legal liabilities. The Association has fought in court the occasional practice of communities and other governing bodies to require competitive bidding for engineering work and has succeeded in having the California Supreme Court state clearly the disadvantages of retaining engineering or professional services on any kind of competitive price basis. A brochure is being prepared describing the consulting firms in California and giving a summary of their professional activities.

General Discussion

The report of the California Association completed all of the representatives' explanations of the operations of their own societies. By this time it had become quite clear that the basic question facing this group was whether to organize their own National Federation or to take steps that would lead toward operation through the new Functional Groups of the National Society of Professional Engineers. Mr. Kirkwood of Kansas City, presented a full and complete argument giving the NSPE point of view. He detailed the actions of NSPE at their recent Memphis meeting and read a report covering the action that authorized the setting up of Functional Groups including a Functional Group for consulting engineers.

Luncheon

The principal speaker at the luncheon was Col. George E. White, Jr., District Engineer, St. Louis Corps of Engineers, U. S. Army. He spoke on "Engineers in Government." Col. White stated that the Corps of Engineers was set up to handle the basic load of engineering work designated to it by the Federal Government. However, there were many peaks of activity, and it was his opinion that these should be handled by consulting engineers rather than by expanding the Corps.

Following the luncheon, Mr. Roy H. Comstock, Chief Engineer of O-Z Electric Company, addressed the group on the subject of manufacturer's relations with consulting engineers. Mr. Comstock agreed that manufacturers should stay out of engineering design and work closely with consultants rather than in competition with them. He said that he felt most manufacturers would be in sympathy with a National Federation of Consulting Engineers and that such an association could do much to define the limits to which the manufacturers might go in design work.

Resolution

Joe Williamson then called upon Pecos Calahan, Chairman of the Steering Committee, appointed the previous day, to present a report. The committee presented the resolution reproduced in the box on Page 59. After presenting this resolution, Calahan stated that he had made a rough tabulation of the total memberships of the ten associations represented at the meeting and that it came to 700 members.

Mr. Williamson then called for a vote to the effect that consideration be given to a National Federation to represent the various consulting associations present at the meeting. When a vote was called, the representatives of the ten associations voted unanimously in favor of consideration being given.

A steering committee then was elected, composed of Mr. John K. M. Pryke of New York, Mr. Pecos Calahan of California, Mr. T. C. Roche of Minnesota, and Mr. B. M. Dornblatt of Louisiana.

A subsequent vote instructed this committee to produce a draft of a constitution and by-laws, which then would be circulated to all associations for consideration and comment within 90 days. Assuming favorable comment from the various associations, a meeting is contemplated that will be attended by delegates from the various associations to vote on the proposed constitution and by-laws for a National Federation of Associations of Consulting Engineers.

Conclusions

The meeting may be summarized in this way:

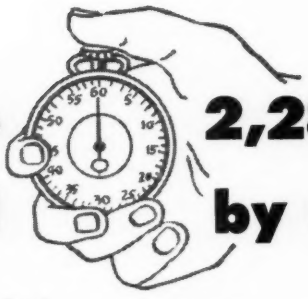
¶ Representatives of ten associations were at the meeting. Each presented an outline of his association's organizational structure and a list of its accomplishments.

¶ The American Institute of Consulting Engineers sent an unofficial observer who explained the position of that organization.

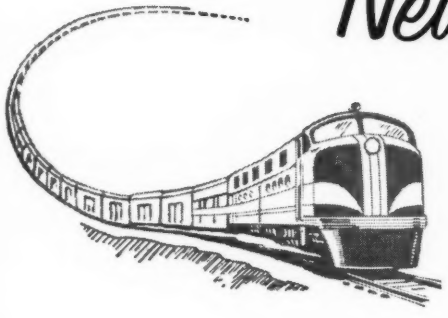
¶ A Director of the National Society of Professional Engineers explained the new Functional Group plan and the sincere desire of NSPE to represent consultants on both state and national levels.

¶ A resolution was presented proposing that consideration be given to the formation of a National Federation and that a committee draft a constitution and by-laws within 90 days. This resolution was passed unanimously by representatives of the 10 associations of consulting engineers. ▲ ▲

Every minute handled 2,281,623 cu. ft. of air by CLARAGE in



New York's new Coliseum



. . . enough to fill a train of boxcars 5½ miles long

One of the biggest air handling assignments on record — and Clarage all the way!

For the Coliseum's colossal requirements, 75 Clarage Fans, 24 Unicoil Sprayed Coil Units, and 14 Multitherm Conditioning Units were selected. This choice, we feel, is an outstanding tribute to the worth of our equipment. Obviously, in a structure of this type, there could be no compromise with quality. Only the finest could qualify.

Make sure *your* investment in air handling and conditioning is a profitable one. Investigate the equipment we have perfected for every type of application.

CLARAGE FAN CO., Kalamazoo, Michigan

OWNER — Triborough Bridge & Tunnel Authority
ARCHITECT — Leon and Lionel Levy
MECHANICAL ENGINEER — Guy B. Panero
STRUCTURAL ENGINEER — Dr. Jacob Feld
GENERAL CONTRACTOR — Walsh-Fuller-Slattery
HEATING, VENTILATING AND AIR CONDITIONING CONTRACTOR — Almirall & Co., Inc.

CLARAGE

. . . dependable equipment for making air your servant

SALES ENGINEERING OFFICES IN ALL PRINCIPAL CITIES • IN CANADA: Canada Fans, Ltd., 4285 Richelieu St., Montreal

REPORT FROM MADRID

FRITZ D. HIRSCHFELD
European Editor

THE POWER DEVELOPMENT presently underway in Spain is an interesting story. In the next three years Spain proposes to increase its total installed hydro capacity by about 2 million kw and its total installed thermal capacity about 1.3 million kw.

Low Power Capacity

On the steam plants alone, U. S. consultants and manufacturers are participating in 500,000 kw that have been committed or are already under construction. But even this tremendous power expansion program will only boost the kwh per inhabitant from 310 kwh to 670 kwh; still far short of the better than 2000 kwh per inhabitant found in highly-developed countries like the U. S. and Sweden. Most qualified observers agree that 670 kwh per capita will only whet the appetite of the Spaniards for still more power — not only to meet industrial expansion requirements but also to fill the pent-up domestic demands for electricity.

Ever since the Spanish Civil War (1936-1939) Spain has been lying in a shadow caused partly by the bad political implications of a dictatorship and partly by publicity that has headlined the controversial political and religious disputes and neglected the positive economic and industrial developments.

During World War II, Spain, as a neutral, was left to its own resources in trying to rebuild her economy. After the War, the stigma attached to Franco's flirtations with the defeated and discredited Hitler and Mussolini regimes placed Spain outside the orbit of Marshall Plan dollar assistance.

The first real economic break for Spain came when the U. S. Air Force became interested in establishing bases in the country in the early 1950's. Maj. General Kissner (now Chief of the American Joint Military Group) and Mr. George Train (presently headquartered in Madrid as an independent financial and management consultant to American firms doing business in Spain) represented U. S. interests under the Truman administration and negotiated a treaty with the Franco government for the construction of air bases and related necessary facilities (docks, pipelines). This agreement appears to mark a turning point in our attitude and interest in Spain's economic and industrial well-being.

Most Americans think of Spain as a country that has literally lived in an economic vacuum for almost 15 years, has a low standard of living, obsolete equipment and machinery, and a demoralized people. From this extremely pessimistic viewpoint, it has therefore come as a surprise to visitors to find a substantial amount of industrial and construction activity.

I saw no signs of war damage in my own casual observations. New apartment houses and buildings seem to have sprung up like mushrooms. However, Madrid taxicabs and Spanish trolley cars are still collectors' items. The main highways are paved and in fair condition — except where they pass through winding streets in old villages and cities — and every few miles there is generally a construction gang at work (mostly hand labor) repaving, straightening curves, building small stone bridges, removing bottlenecks. Electric power lines parallel the highways. But the power fluctuations in the evening, especially along the southern Mediterranean coast, would cause any U. S. central station engineer to tear his hair.

Economic Problems

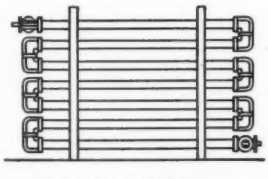
A more realistic picture of Spain's economy comes from a Foreign Operations Administration report dated June 1955. "Spain had an estimated population of 28,750,000 at the end of 1954; the population is increasing at a rate of a little more than one percent per year. The Spanish people have an extremely low level of living in comparison with other Western European countries. The per capita gross national product is less than $250 per year, or roughly one-half of the average for Western Europe.

"The climate of Spain is the driest of any European country, and this fact is the root of many of her economic problems. . . . .

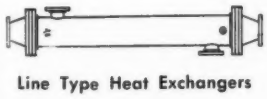
"Spain is basically an agricultural country, with 60 percent of the active population being employed in agriculture. . . . Yields are limited by lack of agricultural machinery, fertilizers, irrigation, erosion control, seed selection, and farm roads. . . . . Spain has fairly extensive mineral resources of iron ore,

Another reason why,
EBKO *is best for complete piping service . . .*

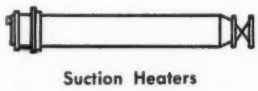
EBKO piping systems can save you thousands of dollars



Stack Heat Exchangers



Line Type Heat Exchangers



Suction Heaters

• EBKO custom designed piping systems are the absolute highest of quality, made with the finest of materials, sold at competitive prices. The keynote of EBKO design is simplicity. Here are some reasons why EBKO should be your first and last choice:

INSTALLATION EASE. EBKO pipe is built stronger than any other prefabricated pipe. Long lengths can be assembled on the ground and raised or at the side of the trench, then lowered. No special handling methods or tools and no special structural supports are needed.

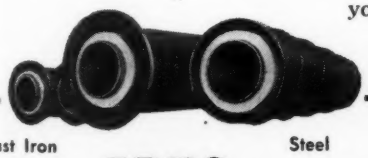
DURABILITY. Never has an EBKO prefabricated piping system failed. EBKO piping joints, both *interior* and *exterior,* can be tested and visually checked after each is assembled. Before you backfill the trench you know the job is sound.

ENGINEERING SERVICE. EBKO engineers will give job-site service prior to and during installation. These are highly trained, experienced men in all phases of piping.

DELIVERY. The simplicity of EBKO design means complete systems can be assembled and shipped in the very minimum of time.

NATIONWIDE SERVICE AND SALES. Factory representatives in every major city are located throughout the United States to answer any question that may arise.

. . . there are many, many more reasons why EBKO should be your first and last choice. Call your local EBKO Representative and let him show you how to cut your piping system costs. Write for details—no obligation.



Cast Iron Steel

EBKO
Complete Prefabricated Piping Systems

E. B. KAISER CO.
Since 1890
2110 West Lake Avenue • Glenview, Illinois
Phone: Glenview 4-4500

FOR STEAM • HIGH TEMPERATURE WATER • CHILLED WATER • VISCOUS LIQUIDS

coal, pyrites, mercury, lead, copper, and sulpher. Based on these resources, Spain has developed a surprisingly varied industrial capacity, almost all of which, however, is antiquated.

"Three key sectors of the economy which exhibit weakness are the following:

a. Electric Power — although thermal power capacity has recently been increased, hydro power still produces approximately 78 percent of Spain's total available electric power. The result is that power production is dependent upon adequate rainfall and severe rationing of power is required in dry years.

b. Transportation — the rail transportation system cannot keep up even with minimum demands. The national railway system has 3400 locomotives, 500 of which are normally in repair shops at any given moment. Some locomotives in present use were built in 1858. There were 521 derailments in 1952 and 496 in 1953, exclusive of yard and station derailments.

c. Steel — production of Spain's steel industry since the (Spanish) Civil War remained below the pre-war annual rate of one million tons until 1954 when 1.1 million tons were produced. This level still leaves Spain with a deficiency in steel production owing to the greatly expanded needs of industry and of a larger population.

d. Obsolescence of Industrial Plants — inability to import up-to-date machinery and equipment during the period beginning with the outbreak of the Civil War, in 1936, until well after the end of World War II, has seriously aggravated the weaknesses in Spain's industrial plant. For example, the textile industry, one of the most important in Spain, is operating with a large amount of machinery of early twentieth century vintage; equipment and machinery in the coal and lead mines, in the steel plants, and in the fertilizer industry are still by and large antiquated, in spite of the installation of new machinery in the past four years . . . "

Power for Irrigation

This information is hardly news to the Spanish. The fact that a prolonged dry spell accounts for a poor crop and rationing of hydro power is accepted as a natural phenomena that defies a quick or easy solution. Building steam stations will provide a reliable power base and in due time probably generate sufficient power to allow the installation of pumping stations for irrigation, which in turn should ease the agricultural problem. The replacement of obsolescent equipment and machinery requires capital investment, and this, too, is a problem that does not lend itself to any pat solutions.

In 1942, the Spanish government set up a state-owned company to invest government money in any enterprises that were thought to be essential to the economy and in which areas private capital could not or would not make the necessary investments. Because the Instituto Nacional de Industria (commonly referred to as INI) was the only large scale source of money in Spain it soon had substantial holdings in many different enterprises. The original idea was that INI would help stimulate private investments and, just as soon as private enterprise was in a position to take over, INI would sell out its interest to private ownership. However, this concept, in operation, has become a bone of contention. Some claim that INI is building up a state-controlled economy at the expense of free enterprise. INI says it is sticking to its original purposes. In any event, INI has a dominant interest in the power industry, among its many other holdings.

American Consultants in Spain

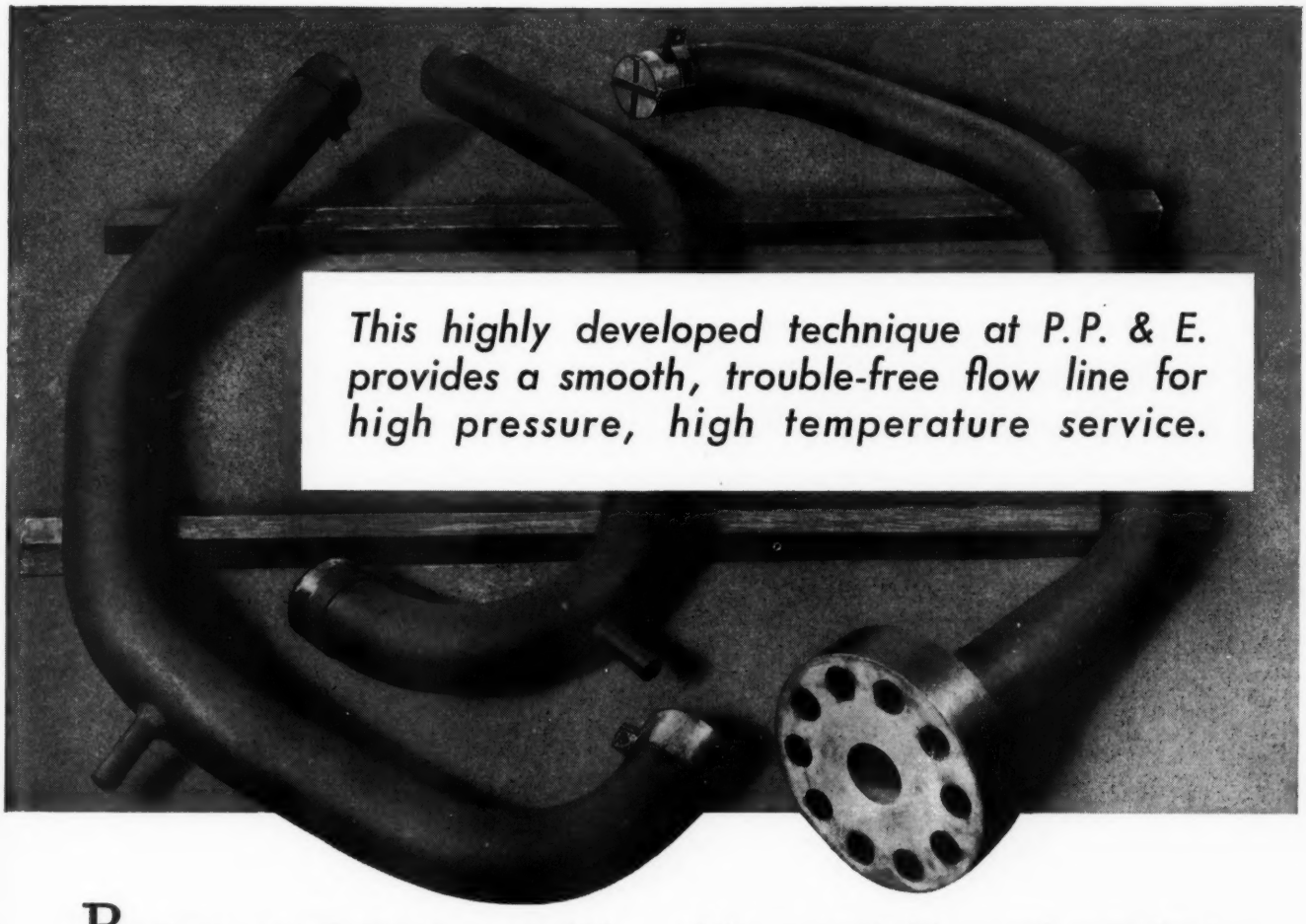
Of the American consulting engineers active in Spain today, it is my impression that those with the most potentially profitable future are Gibbs & Hill and Gilbert Associates. These two consultants are dividing between themselves the roughly 500,000 kw of thermal power plants that will be built in Spain. Furthermore, they are in an excellent position to negotiate the design and engineering work for another million kw of steam power that is already on the books, as well as to participate in the long-term power development that is bound to continue.

The Spanish engineers are well-trained and very capable, but most of them are specialized in civil engineering — in the design of bridges, dams, hydro stations, and similar public works. They have practically no experience in designing thermal stations and therefore must rely on outside assistance. Gibbs & Hill have a small group of engineers working with the Spanish INI to help teach the INI engineers some of the fine points of steam power station design. Gilbert Associates prefer to work out of their Reading, Pa. offices and call over Spanish engineers for training and advice as necessary.

General Electric and Westinghouse, both active in Spain for many years, have gone a long way to help the Spanish finance their power program. By granting dollar credits, guaranteed by two Spanish commercial banks with the consent of the Spanish government, GE and Westinghouse have been able to accept a 40 percent down payment with the remaining 60 percent paid over approximately eight years. Of course, the American Foreign Aid Program has also put up dollars to help underwrite the power program.

My trip to Spain was in one respect an eye-opener. I learned that, contrary to all the publicity, the real story in Spain is not the Spanish Air Bases Program —which because of its military aspects has only a limited interest and future for the American consulting engineer — but power development projects planned and underway upon which will be based the country's future industrialization. In this work there is a real need and many opportunities for American consulting engineers and their know-how.

Hot Bending at Pittsburgh Piping



This highly developed technique at P.P. & E. provides a smooth, trouble-free flow line for high pressure, high temperature service.

Bending heavy wall piping is an art which provides a pipe line having best flow characteristics, with turbulence held to a minimum.

Pipe bending saves fabricating time and material . . . permits designing the pipe line to fit exactly into available space. There are fewer welds in the completed system, and field welding can be confined to areas least subject to high stress. Pipe and bends are of the same material . . . and, as produced at P.P.&E., wall thickness and metallurgical and mechanical properties are consistent throughout the fabricated assembly.

Comparatively few men are qualified by training, experience and skill to bend pipe for high pressure, high temperature service . . . fewer plants have the necessary facilities. P.P.&E. has both the men and facilities.

PRODUCTS AND SERVICES

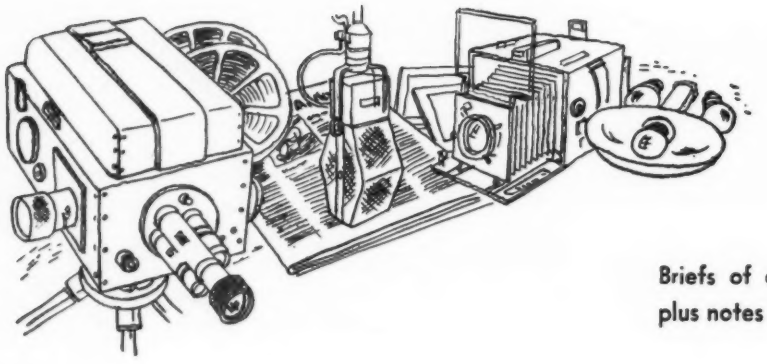
Carbon Steel Piping	Forged Piping Materials
Cast Iron Fittings	Headers
Cast Steel Fittings	Manifolds
Chrome-Moly Piping	Pipe Bends
Copper Piping	Stainless Steel Piping
Corrugated Piping	Van Stoning
Creased Bends	Welded Assemblies
Expansion Bends	Welded Stainless Steel Tubing
Flanges	Welding Fittings

Pittsburgh Piping AND EQUIPMENT COMPANY
158 49th Street — Pittsburgh, Penna.
CANADA: CANADIAN PITTSBURGH PIPING, LTD.
835 BEACH ROAD—HAMILTON, ONTARIO

OFFICES IN PRINCIPAL CITIES

Atlanta	Whitehead Building
Boston	10 High Street
Chicago	Peoples Gas Building
Cleveland	Public Square Building
Houston	Heights State Bank Building
Los Angeles	1830 North Alexandria Ave.
New Orleans	P. O. Box 74
New York	Woolworth Building
Syracuse	113 So. Salina Street
Toronto	68 Yonge Street
Washington	Wire Building

PP-14



NEWS

Briefs of current interest to the consulting profession plus notes on new equipment in the field of engineering

Credit, Where Credit Is Due

The seven engineering wonders of the U. S., as chosen by the membership of the American Society of Civil Engineers, have received wide-spread publicity on radio and in the press, but little mention has been made of the engineers responsible for the building and design of these projects.

The seven projects—Chicago Sewage Disposal System, Colorado River Aqueduct, Empire State Building, Grand Coulee Dam, Hoover Dam, Panama Canal, and San Francisco-Oakland Bay Bridge —were chosen on the basis of their usefulness, value of the project as reflected by later imitation, beauty, and size.

The Chicago Sewage Disposal System was designed and engineered by the Sanitary District of Chicago. The original idea and plans for reversing the flow of the Chicago River and construction of a drainage canal were the work of Lyman Cooley, chief engineer of the District before the turn of the century, and later trustee of the District. Other engineers who carried out these plans and augmented them with sewage disposal plants between the 1900's and the present day were Isham Randolph, George M. Wisner, Langdon Pearse, and the present chief engineer, Horace P. Ramey.

The Metropolitan Water District of Southern California designed the Colorado River Aqueduct, with E. F. Weymouth as general manager and chief engineer, Julian Hinds as assistant chief engineer, and J. L. Burkholder as assistant general manager.

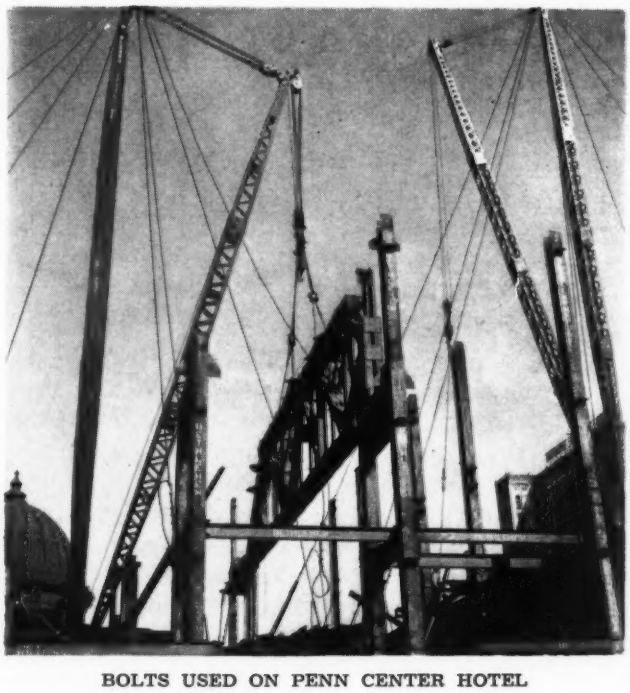
Consulting engineer on the Empire State Building was H. G. Balcom; architects were Shreve, Lamb and Harmon, of New York.

Grand Coulee Dam was a joint venture of Mason-Walsh-Atkinson-Kier Co. as contractor and the Bureau of Reclaimation with George D. Riddle, of New York, as chief engineer. Chief designing engineer was J. L. Savage; chief engineer, S. O. Harper; construction and supervising engineer was Frank A. Banks; and Commissioner of Reclamation, John C. Page.

The Bureau of Reclaimation also designed Hoover Dam, with Edward Mead as Commissioner of Reclaimation. H. M. Westergaard acted as consulting engineer to the Bureau. The Bureau's chief engineer was K. F. Walter, with J. L. Savage as chief designing engineer. John C. Page became Acting Commissioner on the death of Mead.

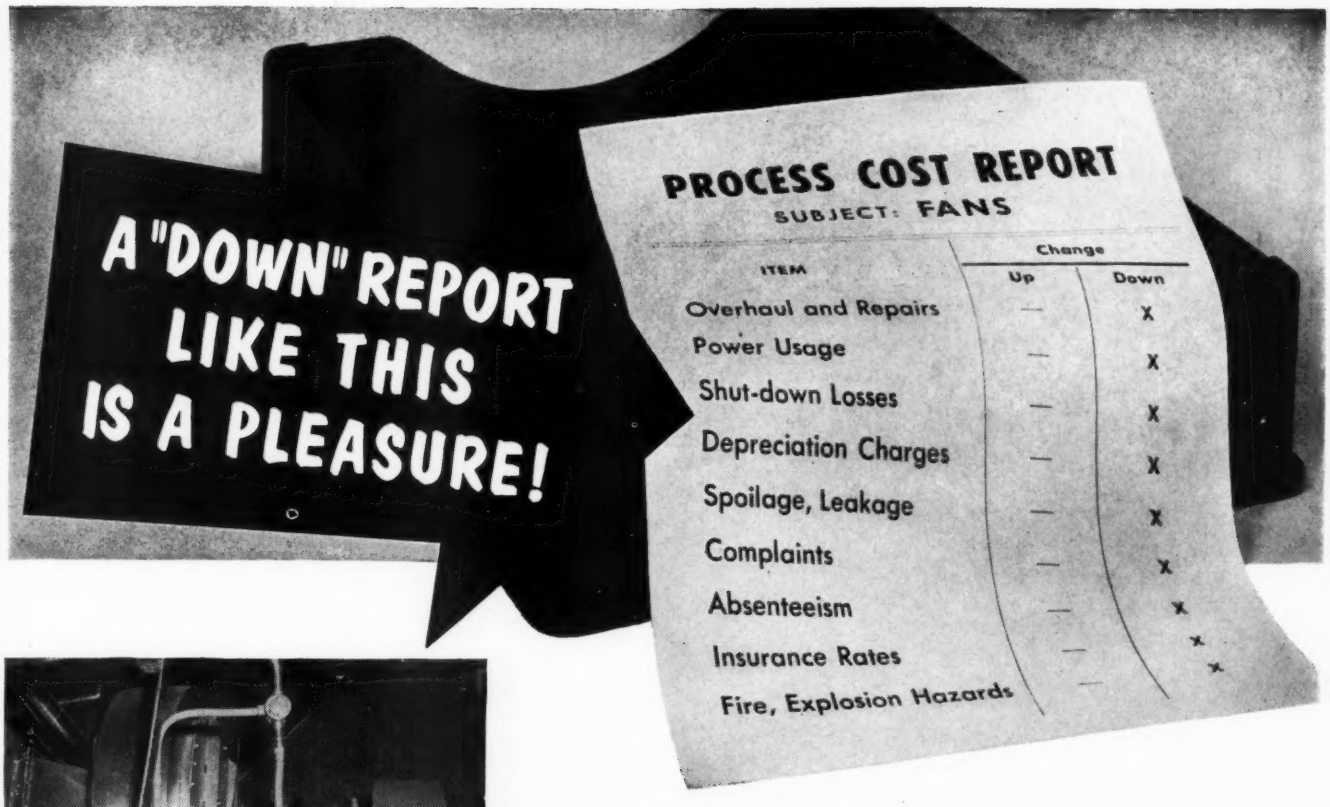
In 1905, John F. Stevens became chief engineer of the Panama Canal project, and two years later, in 1907, Lieut. Col. George W. Goethals became head of the Panama Canal Commission. Under Goethals the locks were built and construction finished.

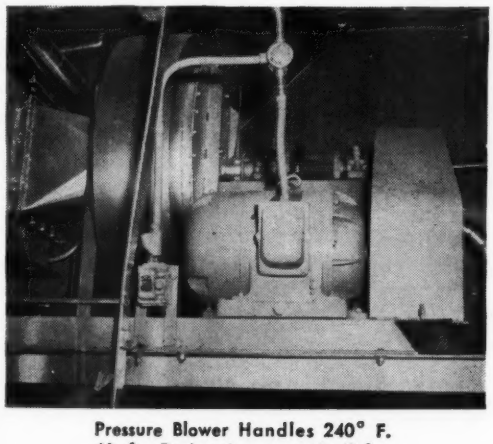
On the San Francisco-Oakland Bay Bridge, C. F. Purcell was chief engineer; Charles E. Andrew, bridge engineer; and Glenn B. Woodruff, engineer



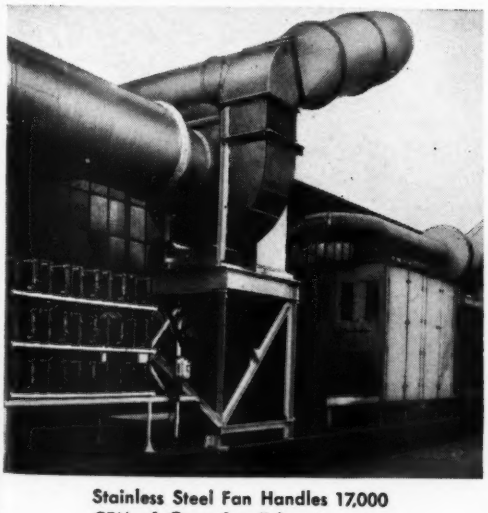
BOLTS USED ON PENN CENTER HOTEL

Erection of this steel truss for the new Sheraton Hotel, Philadelphia, marks the first use of high-strength bolts for construction in that city. The Philadelphia Board of Building Standards amended the building code to allow use of the bolts. Maurice A. Reidy, of Boston, is structural engineer. Perry Shaw and Hepburn — Kehoe and Dean, also of Boston, are the architects.





Pressure Blower Handles 240° F. Air for Drying Aureomycin Cake. Gas-tight, Sparkproof Construction.



Stainless Steel Fan Handles 17,000 CFM of Corrosive Exhaust Gases. at 1000° F.

...To All Engineers Concerned with Reducing MAINTENANCE COSTS

Efficient air handling systems are vital in chemical and industrial plants for processing, by-product recovery, conveying, waste disposal, combustion, and many other essential functions. Corrosion here can take a heavy toll in excessive operating and maintenance costs.

Losses from corrosive destruction can be greatly reduced by installing fan equipment specially designed for efficient handling and effective protection under the specific conditions involved.

FOR MAXIMUM RETURN on your FAN investment, install the fan best suited to your needs. Design, construction, selection and application of fans for corrosive service demand highly specialized engineering and manufacturing skills. You get all these from BAYLEY — plus a complete line of fans in types, sizes, and protective treatments for virtually any duct or piping system.

Refer your application problems to **BAYLEY**

Bayley BLOWER COMPANY

6610 W. Burnham Street • Milwaukee 14, Wisconsin

of design. The Board of Consulting Engineers included Ralph Modjeski, Daniel E. Moran, Carlton S. Proctor, Leon S. Moisseiff, Charles Derleth, Jr., and H. J. Brunnier.

The poll of ASCE members was conducted by a six-man committee made up of Waldo G. Bowman, editor of *Engineering News-Record;* James Kip Finch, Dean Emeritus of Columbia University School of Engineering; Louis R. Howson, Partner in Alvord, Burdick & Howson, consulting engineers; Malcolm Pirnie, past president of ASCE, American Institute of Consulting Engineers, and American Water Works Association; Daniel V. Terrell, Dean, College of Engineering, University of Kentucky; and Ralph A. Tudor, head of Tudor Engineering Co.

Annual Meeting of AICE Set for January 16

"Russian Competition in Fields of Engineering" will be the subject of a talk by Dr. John R. Dunning, Dean of Engineering, Columbia University, before the December 7 luncheon meeting of the American Institute of Consulting Engineers. The meeting will be at the Engineers' Club, 32 West 40th Street, New York City, at 12:30 P.M.

The Annual Meeting of AICE has been set for January 16, also at the Engineers' Club, at 2 P. M.

LEARN ABOUT Speedline
STAINLESS STEEL FITTINGS
Speedline
22 Illustrated Pages Tell You HOW and WHY SPEEDLINE FITTINGS
• Speed piping installation
• Simplify design and assembly
• Cut process piping costs!
Write for YOUR Speedline Fittings Catalog Today... it's the Biggest News in Process Piping in Years!
®SPEEDLINE is a registered Horace T. Potts Co. trademark.
Distributors are located in principal cities from coast to coast
Speedline STAINLESS STEEL FITTINGS
manufactured by HORACE T. POTTS COMPANY
522 East Erie Avenue • Philadelphia 34, Pa.

A Trend Toward Group Advertising

At a recent meeting of the California Council of Architects, there was considerable discussion of group advertising. The architects present generally felt that it is unethical and professionally degrading to advertise individually, but there seemed to be sentiment in favor of advertising as a group. This would mean that such groups as chapters of the AIA could profitably, and ethically, advertise the advantages of using an architect.

The Consulting Engineers Association of California has for some time been promoting the use of consulting engineers by placing ads in such publications as the West Coast Edition of the *Wall Street Journal* and *Western City*. This is considered an ethical approach to the problem of educating prospective industrial and municipal clients on the merits of working with consultants.

Prefabricated Heliports In Production

"Helicopters are still in their infancy. But tomorrow they, too, may have pretty hostesses and a red carpet approach. It is not too early to start planning. The subject of mid-town heliports should receive immediate attention," according to R. D. Tufford, president of Standard Heliports, Inc., developer and designer of heliports for waterways, rooftops, and dry land.

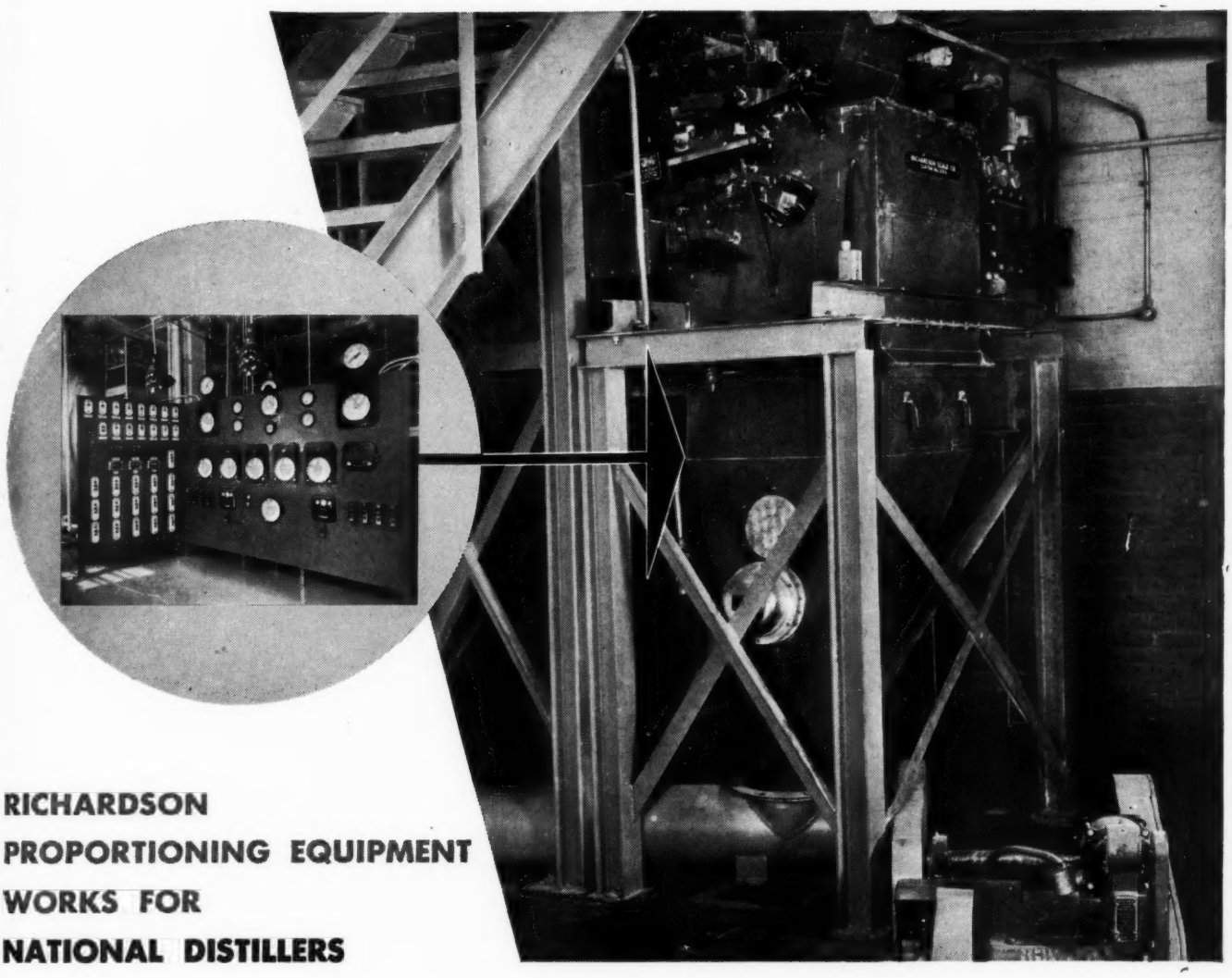
He will act in an engineering and consulting capacity with Dravo Corporation, who will manufacture prefabricated all-steel heliports through an arrangement with Tufford's firm.

He predicted that in the future most platforms would be of the floating type, anchored in rivers, lakes, or bays adjacent to downtown areas, since open waterways are safer, more convenient, and more economical than the limited space offered by roofs of tall buildings or ground level heliports in congested areas.

The standard heliport consists of structurally supported sections of open steel grating that serve as landing and take-off pads or cushions for the helicopters. The open grating and a deflector-pressure surface below it absorb the downwash of the horizontal rotor or propeller, and the grating provides for drainage of water and mud.

The standard heliport for waterways has a flight deck made up of sections, each 10 by 40 ft, with automatic stabilizing provided by pivotly-mounted floats that cushion impact of landings and takeoffs. This floating platform can be anchored in as little as 2½ ft of water and will be equipped with a ramp for automobile approach from shore to flight deck. The method of anchorage depends upon such factors as shore line, water depth, and tide ranges. Two types are available: a cable from shore to heliport and a telescoping piling arrangement.

Besides the short-range haul from airport to downtown districts, Tufford suggested use of the helicopter for trips of less than 150 miles between towns and for transporting freight to and from ships.



RICHARDSON PROPORTIONING EQUIPMENT WORKS FOR NATIONAL DISTILLERS

PROBLEM:

To proportion corn meal, rye meal and malt to the cookers of a large distillery in a CONTINUOUS STREAM, ACCURATE BY WEIGHT.

SOLUTION:

Installation of three Richardson Automatic Hopper Scales, with a control panel to coordinate scale action. Screw feeder and screw take-away conveyors provided a simultaneous, continuous, timed discharge of ingredients to the distillery cookers. The proportions of the ingredients, accurate to ¼ of 1%, can be conveniently altered for different formulae.

National Distillers Products Corporation, in their appeal to the public's palate, must rigidly follow individual and highly intricate formulae. Doing this involves a problem in precision proportioning. To solve it, National Distillers Products Corporation called upon the Richardson Scale Company to design and build the equipment to do this job. Richardson did just that. The result: rapid, accurate blending, and an end product that is consistent and distinctive.

Engineering and building systems for materials handling by weight has been a Richardson specialty for more than half a century. There is at your service a wealth of practical experience in every branch of the process industries. *Proven results* reinforce our claim that there is no pre-weighing, proportioning or mixing problem that cannot be solved efficiently and economically by Richardson engineers. If *your* product requires accurate proportioning, why not call in a Richardson Engineer and have him survey your present methods. There's no obligation on your part—and his suggestions can point the way to more profitable operations and readier sales.

Richardson Scale Co., Clifton, New Jersey. Feeder—Weigher Systems of All Types: Automatic Bulk Weighing Hopper Scales, Including Conveyor-Feed Types —Continuous Feeder-Weighers—Automatic Bagging Scales—Bag-Sewing Conveyors —Packers—Process Control Panels. *Branch offices in:* Atlanta • Boston • Detroit Minneapolis • Cincinnati • Wichita • Montreal • Omaha • New York • Pittsburgh San Francisco • Toronto • Buffalo • Chicago • Philadelphia • and Houston.

Richardson

MATERIALS HANDLING BY WEIGHT

6768

MEN IN ENGINEERING

Dr. Harold S. Osborne, president of the International Electrotechnical Commission has received the 75th Anniversary medal of The American Society of Mechanical Engineers for "his splendid and outstanding leadership in IEC, and as its president."

S. A. Guerrieri is appointed to the technical staff of the Lummus Company.

A new firm, Engineering Design and Development Company, has been established to do design, consulting, and construction work on chemical, metallurgical, and industrial plants. P. Sphaellos heads the organization.

The H. K. Ferguson Company has appointed Walter V. Stearns as chief petroleum engineer, a newly-established position. Stearns will coordinate and supervise specialized process design work.

The United Engineering Trustees, Inc. has elected Walter J. Barrett as president for 1956. Barrett is also treasurer and director of the American Institute of Electrical Engineers, a director of the Engineers Joint Council, and electrical coordination engineer of the New Jersey Bell Telephone Co., Newark.

Michael Baker, Jr., Inc. has announced appointment of two new vice presidents: Richard A. Haber as vice president-Contract Development Division and Joseph F. Bontemp as vice president and architect associate.

Harold D. Beebe has been elected a vice president of Stone & Webster Service Corp. He has been head of the Electric Department since 1954.

Donald H. Cornish has been appointed to the newly-created position of executive director of the Cleveland Engineering Society. He will serve as secretary of the Society and the Board of Governors.

At the annual meeting of the Association of Consulting Chemists and Chemical Engineers, Inc., the following new officers were elected: president, Carl Bussow, of A. W. Dow, Inc.; vice president, Foster D. Snell, of Foster D. Snell, Inc.; secretary, Earl D. Stewart, Schwarz Laboratories, Inc.; treasurer, William C. Bowden, Ledoux & Co., Inc.

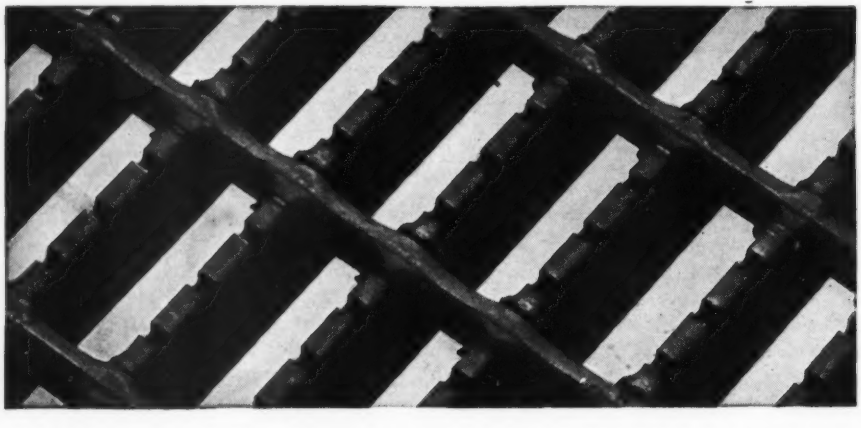
Leonard E. Cordes, formerly a principal of Cresap, McCormick & Paget, announces formation of Cordes & Company, Inc., management consultants. Offices are at 99 Park Avenue, New York City and Noroton, Conn.

Dr. Lee deForest has been presented the first ISA Achievement Award by the Instrument Society of America at its 10th Annual Conference & Exhibit.

The American Institute of Consulting Engineers has awarded its 1955 Award of Merit to Benjamin F. Fairless, Chairman of the Executive Advisory Committee, U. S. Steel Corp.

Wendell Beard, formerly a partner in the firm of Freese, Nichols and Turner, has opened his own offices at 308 Rusk Building, Houston 2, Texas.

President of the American Institute of Chemical Engineers for 1956 is Walter Gordon Whitman, head of the Department of Chemical Engineering at Massachusetts Institute of Technology and Conference Secretary-General, United Nations International Conference on Peaceful Uses of Atomic Energy. Vice president is J. Henry Rushton, professor of chemical engineering at Purdue University. Re-elected were F. J. Van Antwerpen, as executive secretary and George Granger Brown, dean of engineering at the University of Michigan, as treasurer.



New Slip-Proof Design makes

Gary SERRATED GRATING safest

WHERE GOOD TRACTION IS IMPORTANT

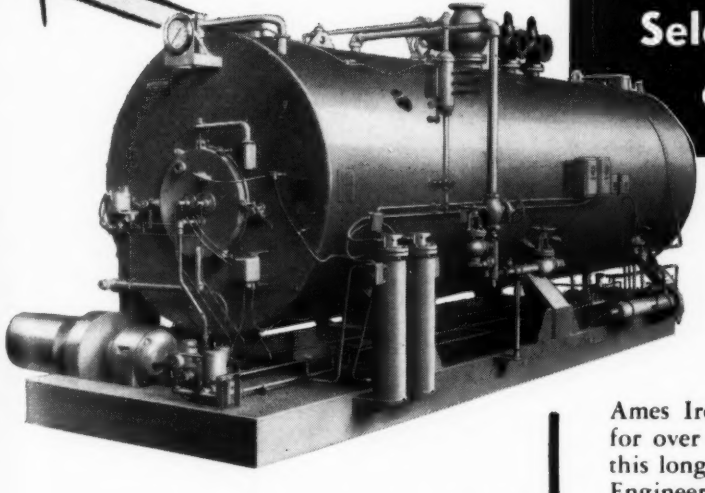
Indoors or out, for area gratings in sidewalks, inclined walkways, fire escapes—wherever safe-footing is important, this one-piece, resistance-welded grating will provide safer working conditions. It's tailor-made to your requirements. Write for descriptive Catalog CE-125

FREE SAMPLE
We'll send this handy paper weight if you request it on your company stationery.

Standard Steel Spring Division
ROCKWELL SPRING AND AXLE CO.
4015 East Seventh Avenue • Gary, Indiana

SO YOU HAVE TO BUY A BOILER!

Select an AMESTEAM GENERATOR and solve all your problems



You don't have to dig through mountains of data to pick the boiler that will give your company the most economical and satisfactory service! It's more a question of *where* you buy it than what boiler you choose. What's the maker's reputation?

Ames Iron Works have been building boilers of quality for over 100 years. Back of every Amesteam Generator is this long, successful experience — represented by the Ames Engineering Staff, a large group of skilled boiler makers and an efficient, nation-wide sales and service organization at your disposal. Yes, quality and experience *do* count — and the thousands of Amesteam Generators giving dependable, low-cost service in power, process and heating applications are proof of it. Why not be *sure* by specifying Amesteam Generator? Write today for details and name of your Ames representative.

AMESTEAM GENERATOR

- 80% guaranteed thermal efficiency.
- Single economical package purchase.
- Package installation economy.
- Completely safeguarded.
- Easy, inexpensive maintenance.
- 20 sizes, 10 to 600 H.P., 15 to 200# W.P., oil, gas or oil-gas combinations with quick fuel switchover feature.

AMES IRON WORKS, INC.

BOX P-125, OSWEGO, N. Y.

Notes FROM ABROAD

Aluminum Foil for Concrete Pipelines

Considerable difficulty has always been encountered in making reinforced concrete pipelines impervious under pressure. A method has now been developed in Italy for successfully using aluminum foil in pressure pipelines in applications where it is necessary that they remain tight under high pressures.

The method of using aluminum foil is based on a simple principle. It can be demonstrated in practice that if even the thinnest metal foil is applied with a suitable adhesive to a concrete or reinforced concrete slab, the slab can withstand extremely high water pressure without breaking or letting any water leak through.

In practice, liners consisting of several layers of aluminum foil, in crossed strips or overlapping, each about a thousandth of an inch thick, are used. They are laid on the reinforced concrete wall of the pipeline without any pretreatment immediately after the falsework has been dismantled. Special bitumen base, or natural or synthetic resin base adhesive mastics are used, both for the first and the successive layers, until the finished liner is completed.

It is considered advisable to adopt multiple layers to obviate any eventual unevenness, or slight incidental tears, as well as to stagger the joints between single overlapping foils. However, the total final thickness of the liner is generally little more than 1/25th of an inch. A protective layer of wired concrete may be placed over the aluminum foils.

Pipelines provided with this thin liner have proven impervious at extremely high internal pressures and remained tight even where unforeseen causes or intentional excess test pressures produced visible cracks in the reinforced concrete pipe.

Norway Schedules Big Hydro Program

Norway's largest reserve of water power — at Tokke, in Telemark, southeast Norway — is to be developed into one of the world's biggest hydroelectric projects. The aim in the first construction phase is to achieve a generating capacity of 400,000 kw, to yield an annual output of 2 billion kw-hrs. This is almost 10 percent of Norway's total present output of electricity. A further development beyond 400,000 kw is foreseen with a final target of 700,000 kw installed capacity.

The cost of the first construction phase is put at almost $56 million. The Norwegian government has had talks with the International Bank in Washington regarding a loan for the development of the Tokke water-power reserve. However, the Norwegian Parliament has already approved an initial appropriation to cover preparatory work.

It is interesting to note that since the war, Norwegian hydro generating capacity has gone up from

EXTRA YEARS

OF MORE DEPENDABLE POWER
and at less cost per pound of steam

TODD BURNERS

GAS OR OIL

PRODUCTS DIVISION

TODD SHIPYARDS CORPORATION

HEADQUARTERS:
Columbia & Halleck Streets, Brooklyn 31, N. Y.

PLANT:
Green's Bayou, Houston 15, Texas

TODD
NEW YORK, U.S.A.

. . . special to consulting engineer

2,328,000 kw to 3,848,000 kw and the annual output of electricity has almost doubled. Consumption of electricity, at about 6500 kw-hrs per person, is the highest in the world and more than twice as high per capita as in the U.S. Although expenditures on hydro-electric projects have cost almost $56 million since 1945, only about one-sixth of Norway's water power resources have been developed up to this time.

Austria Plans A-Plant

The Austrians are planning to construct their first atomic electric power plant in the Danube River valley. The new atom plant will have a capacity of 10,000 kw and will cost approximately 100 million Austrian shillings ($3,-850,000). As yet, no dates have been set for the start or completion of the project.

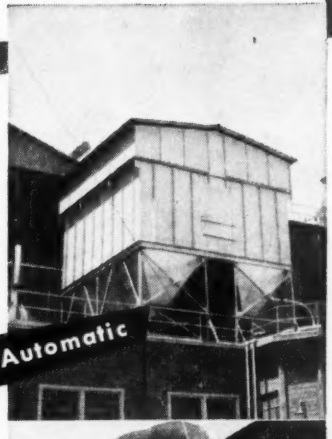
Uranium in Norway

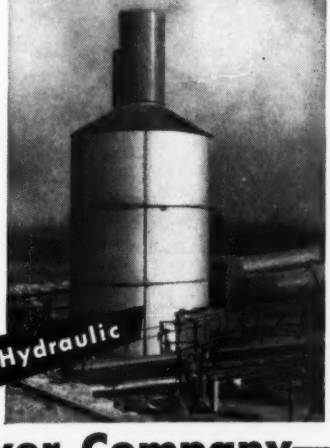
The Norwegian government announces that an important uranium strike has been reported from Finnmark, in the northernmost part of Norway. Measurement of the radio-activity of the samples, made by the Norwegian Geological Laboratory in Oslo, shows 0.5 percent uranium. However, because the strike is in a wild and remote district, fairly inaccessible, the extent of the deposit has not as yet been fully determined. The discovery of uranium deposits in Norway may stimulate further exploration in these northern Scandinavian

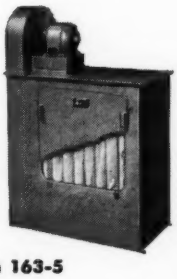
Buy Guaranteed Efficiency in your Dust Collection...

Consult Norblo

Guaranteed efficiency of fume and dust collection systems engineered and built by Norblo is obtainable because Norblo Equipment includes automatic bag type, improved centrifugal, and hydraulic types. Your operations may require one of these types — or all three! Norblo can tell you — will engineer the necessary combination to handle your dust and fume collection at most economical cost. More than 40 years experience serving many industries. State your problem so we can send literature on equipment applicable to your needs.







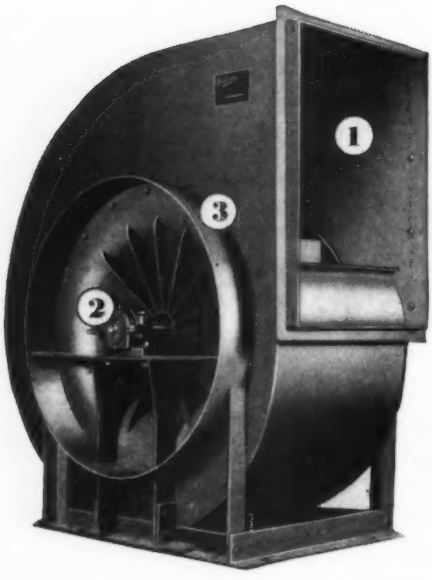
Norblo *Portable* Dust Collecting Units solve many localized problems.

Ask for Bulletin 163-5

The Northern Blower Company

Engineered Dust Collection Systems for All Industries

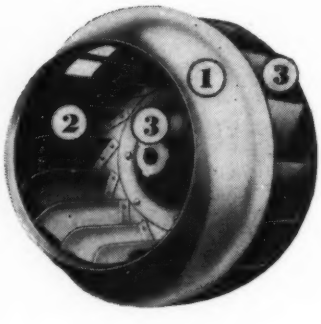
6426 Barberton Ave. OLympic 1-1300 Cleveland 3, Ohio

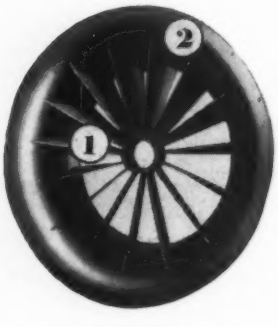


Double-Check
EVERY FEATURE!
✓ ✓
SEE THE MANY EXTRA PERFORMANCE FEATURES THIS FAN ALONE OFFERS

"Buffalo" Type "BL" Limit-Load VENTILATING FAN The photo above shows three of the unique features in the "BL" Fan which are giving users more for their money: (1) properly proportioned housing, streamlined for peak efficiency; (2) "Buffalo" self-aligning bearings (choice of sleeve or anti-friction type) for easiest maintenance and longest life; and (3) large, smooth inlet collar for easy duct connect.on.

ROTOR FEATURES Note the unusual rotor design which has made for exceptional stability and efficiency of performance. (1) Shroud is die-formed to full curvature to match inlet bell for proper air flow in wheel. (2) Backward-curved blades are die-stamped, welded and riveted for maximum strength — and insure stable air flow. (3) The heavy-gauge back plate and extra-heavy hub provide strength where it's needed.





FREE-FLOW INLET Note "Buffalo" inlet guide vanes (1) which assure full rated delivery with minimum turbulence even when inlet conditions are unfavorable. Inlet losses are further reduced by the smooth, die-formed inlet bell (2) which matches the wheel shroud.

These and other features contribute to the famous "Buffalo" "Q" Factor — the built-in Quality which provides trouble-free satisfaction and long life — the best value you can recommend in a fan. For full details, write for Bulletin F-102.

"Buffalo"

BUFFALO FORGE COMPANY
147 MORTIMER ST. BUFFALO, NEW YORK
PUBLISHERS OF "FAN ENGINEERING" HANDBOOK
Canadian Blower & Forge Co., Ltd., Kitchener, Ont.
Sales Representatives in all Principal Cities

VENTILATING AIR CLEANING AIR TEMPERING INDUCED DRAFT EXHAUSTING
FORCED DRAFT COOLING HEATING PRESSURE BLOWING

areas, as well as give impetus to atomic power plant research and development.

India Plans Factory

India will engage the British firm, Associated Electrical Industries, Ltd., of London, to act as consultants in the construction of a nationalized heavy electrical equipment factory. The factory may cost as much as $52 million.

Insuring Atomic Risks

At the recent congress of the International Union of Maritime and Transport Insurance held in the Principality of Monaco, problems of covering atomic risks were discussed by the representatives from insurance organizations in 37 countries. Insurance coverage for atomic risks will undoubtedly hasten the acceptance of atomic applications in industry.

Paris Tunnel Prize

The City of Paris has offered a prize of about $28,000 for the best design for a four-mile long tunnel to be bored under the capitol from north to south. This is the latest of a series of projects to help solve Paris's traffic problems.

Rhodesian Steel Development

Negotiations are taking place for a consortium of British financial and steel interests to take over the entire resources of Southern Rhodesia's iron and steel industry. Mr. Geoffrey Ellman-Brown, Southern Rhodesia's Minister of Road Traffic, Irrigation, and Housing, has spent some time in Britain investigating the possibility of expanding his country's steel works and of developing its "tremendous" iron ore resources.

Many European countries are interested in investing in Southern Rhodesia and in setting up their own concerns according to Mr. Ellman-Brown. "We are anxious to encourage those firms which will come out and assist us. It is a sound proposition for investment and if we achieve all we have set out to do, it will be the

ANACONDA INTERLOCKED-ARMOR Cable is installed on simple racks and eliminates the need for conduit. Installation work is finished often in half the time required for other cables.

Cut installation time and cost with cable with its own inbuilt flexible conduit!

When you expand or relocate your power feeders, Anaconda Interlocked-Armor Cable puts you into *full* operation days—sometimes weeks—sooner.

Because it is made with its own tough yet flexible armor, Interlocked-Armor Cable is installed without conduit. Installation time and costs are slashed.

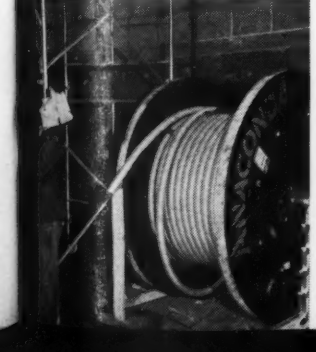
It is laid quickly—indoors or out—on light, easily installed racks. It is trained smoothly around corners, columns and other obstructions in *long, uninterrupted* runs. And this cable's metal tape armor affords high protection against damage.

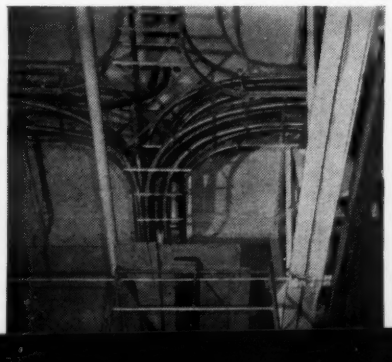
Available in multiconductor construction in sizes No. 6 Awg to 750 Mcm—varnished-cambric insulation up to 15 kv—Underwriters' approval for 600 volts and 5000 volts. Also available with rubber or plastic types of insulations.

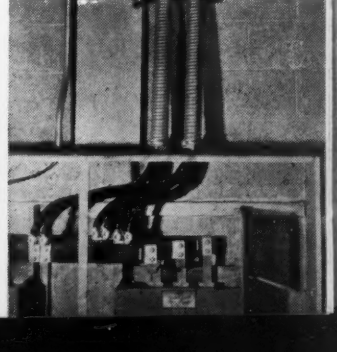
Why not talk to the Man from Anaconda about modern, practical Interlocked Armor Cable today? Or, for information, write: Anaconda Wire & Cable Company, 25 Broadway, New York 4, N. Y. 55281

ANACONDA®

METALWORKING PLANT expands its power system with Anaconda Interlocked Armor Cable (1). Cable drops from ceiling (2) from transformer on floor above, and spreads out (3) carrying more power to local centers (4).







ERNST

SIGHT FLOW INDICATORS

"See What Goes On Inside"

For insertion into pipe

FOR EVERY APPLICATION

BRONZE, IRON, STEEL, STAINLESS STEEL

FIG. 29
Cylinder with Impeller

FIG. 17-28
Cylinder

FIG. 215
Flanged

FIG. E-57
Double Window

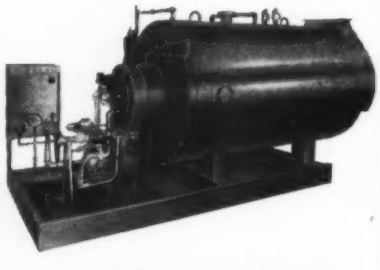
FIG. 212
Visibility Welding Neck or Screw

FIG. E-811
Flapper

FIG. E-1810
Rotating Wheel Type

All sizes up to 6" *Send for Catalog*

ERNST WATER COLUMN & GAGE CO.
LIVINGSTON, N. J.



"PACKAGED" STEAM BOILERS.

Completely Equipped and Tested at factory.

Fully Automatic for Gas or Heavy Oil or Combination Oil and Gas.

60 to 600 Horsepower. High and Low pressure. A.S.M.E. Code and Nat'l Board.

Efficiency and Capacity guaranteed.

Underwriter's Laboratory and Factory Mutual approved.

Detailed Specification Forms, Catalog, and other Engineering Data gladly furnished.

JOHNSTON BROTHERS, INC.
FERRYSBURG, MICHIGAN
Established 1864

beginning of a big industrial development in the whole of Central Africa."

The aim of the discussions are to form a limited company owned and controlled by private enterprise but in which the Southern Rhodesian government would be represented.

Study on Energy Costs

The Organization for European Economic Co-operation has appointed a group of highly qualified experts from various countries to make a study and present a series of recommendations on what can be done at the international level to stem Europe's rising costs of energy production. The United States will send Walker L. Cisler, president of the Detroit Edison Co. and an expert on the production of energy from nuclear power, as an observer.

Today, Europe gets three percent of its energy from water power, one percent from natural gas, 16 percent from petroleum, and 80 percent from coal. By 1965, forecasters say the demand will have risen by 24 percent and the power supply breakdown will be: water power, 5 percent; natural gas, 2 percent (an increase in total output of 400 percent); petroleum, 22 percent; and coal, 71 percent of the total.

The basic problem that motivated the appointment of the OEEC commission is the fact that it is necessary to go deeper and deeper and to work less profitable seams in order to keep coal production to required levels.

The law of diminishing returns is also operative in hydro-electric production. Virtually all the economically desirable sites have already been exploited. To find a suitable new site for a hydro-electric project, it is now necessary to go so high and to do so much damming and tunneling that the cost of the resultant power approaches the non-economical point.

The OEEC experts feel that atomic energy is the obvious eventual solution pending its development on a large scale. At present, they are hopeful that inter-government action on a continent-wide basis will ease the situation somewhat.

For instance, a good deal has already been done to set up a European electric power grid. This is an obvious first move and extensive further work along these lines is expected. Another project under consideration is the creating of a European pipeline network to distribute both natural gas, which has been discovered in some quantities in various areas, and gas made from coal. German technicians have developed a process for the total gasification of low-grade coal, and have managed to mix it successfully with natural gas in a small pipeline system in Germany.

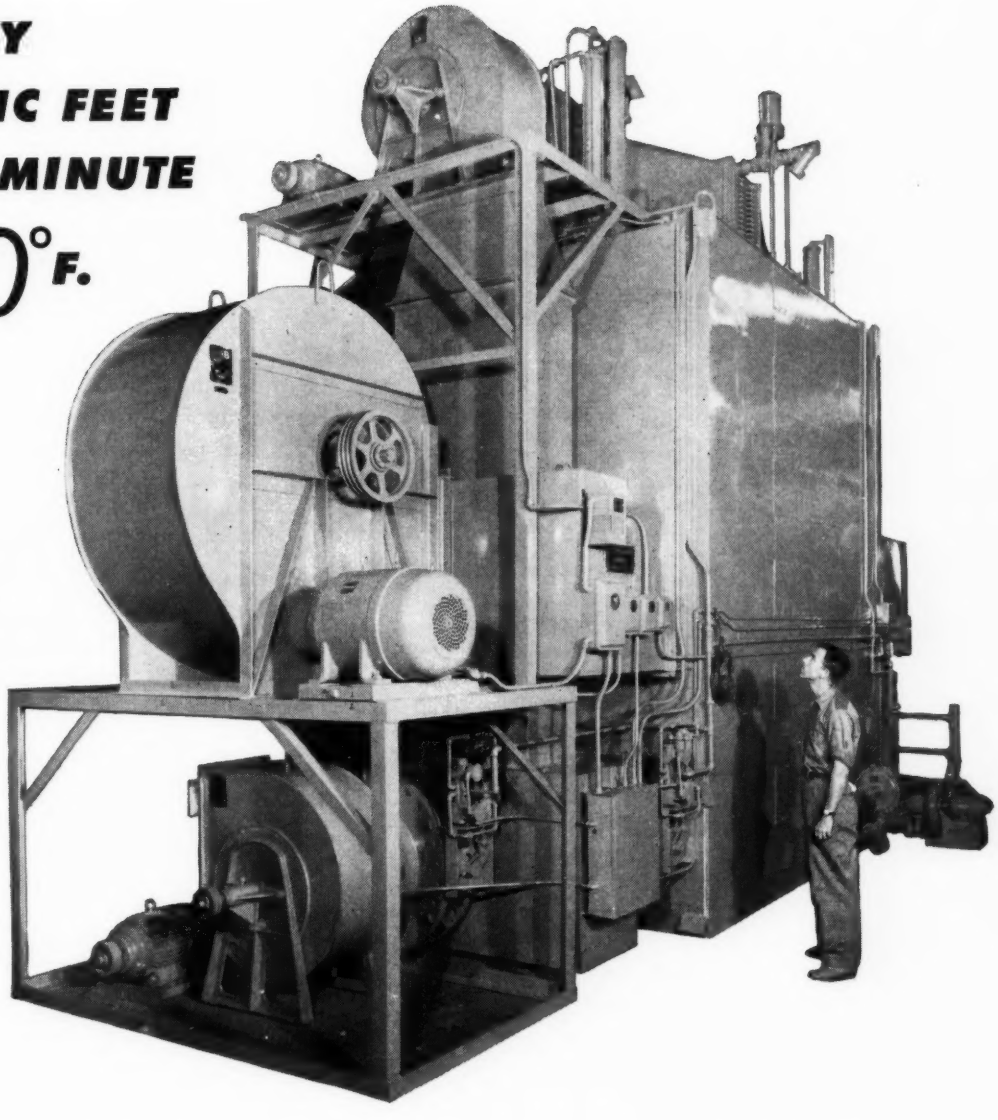
Another project that might be undertaken under the auspices of the new OEEC energy commission is a Continent-wide geological survey. Surprisingly, the Old Continent has not been as extensively and systematically probed and charted as has North America, according to OEEC.

Concrete Railway Ties

The Norwegian State Railways have contracted for the supply of 25,000 concrete railway ties per year for two years. The concrete ties are expected to last much longer than the present 25-year life of wooden ties. They will be manufactured in Norway under a German license. The savings effected by the longer life of the concrete ties can be an important consideration in railway construction and maintenance. The railways in Norway alone use approximately 350,000 ties a year. ▲▲

FOR SALE

TO DRY 12,000 CUBIC FEET OF AIR PER MINUTE TO -50°F.



That's talking BIG! But it's the guaranteed DRYing capacity of this huge Lectrodryer*, just delivered for processing titanium.

IT'S NO GAMBLE for Pittsburgh Lectrodryer Corporation to guarantee the performance of a drier this size. Our engineers have been designing Lectrodryers and assisting in their application for over 23 years—DRYing a few cubic feet per hour, or those tremendous driers on airplane wind tunnels. No wonder they're in such demand whenever an industry is faced with a new DRYing problem.

Your problem with moisture may be metallurgical, as was this one in the new Titanium Industry. It may be simply the sweat on the walls of a room where hygroscopic materials are handled or electronic equipment is assembled. Or it may be complicated, as is often the case where gases or organic liquids are involved in delicate chemical processes. These are familiar problems to our engineers; Lectrodryers have solved many so similar that we can probably give you a quick answer.

Whatever your difficulty with unwanted moisture, we'll welcome your inquiries. The book, *Because Moisture Isn't Pink*, showing various industrial applications will be sent to you free. Write Pittsburgh Lectrodryer Corporation, 357 32nd Street, Pittsburgh 30, Pennsylvania.

In England: Birlec, Limited, Tyburn Road, Erdington, Birmingham
In France: Stein et Roubaix, 24 Rue Erlanger, Paris XVI
In Belgium: S. A. Belge Stein et Roubaix, 320 Rue du Moulin, Bressoux-Liege

LECTRODRYERS DRY WITH ACTIVATED ALUMINAS

LECTRODRYER

* REGISTERED TRADEMARK U. S. PAT. OFF.

HERE'S THE REASON WHY

MERCOID® PRESSURE AND TEMPERATURE CONTROLS

OUTPERFORM AND OUTLAST ORDINARY TYPES

Series "D"

Available for general use, outdoor use or hazardous locations.

● *HERMETICALLY SEALED CONTACT*

Always dependable—whether it operates once per year or several times per minute. It remains operative at all times because dust, dirt, grease or moisture cannot contaminate the contacting elements.

● *OUTSIDE ADJUSTMENTS*

Independent outside adjustments are provided for setting both the cut-in and cut-out points.

● *VISIBLE CALIBRATED DIAL*

No guesswork or calculations are required—the pointers indicate on an accurately calibrated dial, the exact operating pressures or temperature.

● *UNDERWRITERS' APPROVED*

All operating ranges for Series DA-21, DA-35 and DA-55.

WRITE FOR BULLETIN 4B

THE MERCOID CORPORATION

4221 BELMONT AVE., CHICAGO 41, ILL.

LOOKING FOR INDUSTRIAL SITES?

Let "Nick Plate" send you our detailed and accurate "Along the Line" surveys covering natural and agricultural resources, utilities, labor and other pertinent data relating to each specific location. Just tell us the area or type of location you are interested in. Call or write:

H. H. Hampton
NICKEL PLATE ROAD
1405 Terminal Tower, Cleveland 1, O.
Phone: MAin 1-9000

NICKEL PLATE ROAD

Radioactive Waste, Part 1, The U. S. Approach

Starts on page 36

With the hot equipment inside the box, no one could stay within 600 feet of it for more than one-half hour. Ten empty cars separated the locomotive from the 6-ton piece of radioactive "junk" on the trip from the separation plant to the burial ground. Each burial is preceded by a dry run, during which the box is hauled empty from the separation plant to the burial ground to be sure it will pass all gate posts and power lines safely. If on the appointed day the winds blow faster than 10 miles per hr, the operation is postponed. At the burial ground the locomotive stops at a concrete siding at the head of a long trench perpendicular to the rail line. A steel cable attached to the box and looped along the train to the locomotive then is attached to a tractor. The tractor drags the box off the flat car and down a ramp into the trench. The box then is buried by a crane operator dumping a pile of dirt and rocks into the trench, working from behind a pile of dirt and rocks and using mirrors at the end of his long boom.

This same sort of procedure must be followed for disposing of all sorts of highly contaminated solids. The remote control phase of the operation is less stringent for low-level solid wastes, but the same general sort of procedure must be used.

Some work has been done on incinerating burnable low-level trash. Usually, however, incineration generates more waste than it removes. The difficulty is that filters used for particulate removal from incinerator flue gases must be disposed of themselves.

To summarize, the problems of waste disposal are many and varied. Adequate solutions for many of these problems have been applied by the AEC at its own sites, but these solutions may not be adequate for new commercial separation plants. Waste disposal is a field where ingenuity and imagination can pay off by appreciably improving the feasibility of widespread atomic power. ▲▲

Part 2 . . . "The British Approach," starts on page 41

BIBLIOGRAPHY

"Atomic Energy's Biggest Dilemma," *Readers Digest*, May, 1955.

Manowitz, B., "Vapor Compression Evaporation," *Chemical Engineering*, pp 194-196, March, 1955.

Hirsch, C. E., "How Hanford Evaporates Fission Waste," *Chemical Engineering*, pp 184-185, November, 1953.

"Ventilation of Nucleonic Buildings," *Chemical Engineering*, pp 172, September, 1952.

Hayner, J. H., "Liquid Industrial Wastes, Atomic Energy Industry," *Industrial Engineering Chemistry*, pp 472-476, March, 1952.

Hatch, L. P. and Manowitz, B., "Processes for High Level Waste Disposal," *Chemical Engineering Progress Symposium Series*, Vol. 51, No. 12, 1954.

Rodger, W. A., "Radioactive Wastes Treatment, Use, Disposal," *Chemical Engineering Progress*, Vol. 50, No. 5, May, 1954.

Harrington, A. C., Shaver, R. G., and Sorenson, C. W., "Economic Evaluation of Permanent Disposal of Radioactive Wastes," *Nucleonics*, September, 1953.

Hatch, L. P., "Permanent Waste Disposal," *Nucleonics*, September, 1953.

MARLEY IS TESTING COOLING TOWERS

AND HERE IS THE RECORD

TEST NO.	TYPE OF SERVICE AND LOCATION	SPECIFIED CONDITIONS				TEST RESULT	
		Gallons Per Minute	Hot Water Temp.	Cold Water Temp.	Wet Bulb Temp.	[1]Degrees Cold Water Temp.	[1]Percent Capacity
1	Air Conditioning—West Coast	400	90°	80°	70°	+0.80°	+9.4%
2	Air Conditioning—Gulf Coast	6,500	101.3°	88.5°	80°	—0.40°	—4.3%
3	Chemical Plant—East Coast	18,500	104°	89°	76°	+0.50°	+3.8%
4	Chemical Plant—East Coast (1 of 4 duplicate units)	27,500	103°	88°	76°	—0.40°	—3.2%
5	Power Plant—Southwest	57,500	109.6°	92.6°	78°	—0.04°	—0.4%
6	Petroleum Refinery—Gulf Coast	3,400	115°	80°	70°	+0.90°	+8.5%
7	Power Plant—South Central	83,000	108.1°	90°	76°	—0.04°	—0.4%
8	Power Plant—Mountain States	45,000	105°	83.7°	63°	+0.20°	+0.8%
9	Petroleum Refinery—Gulf Coast	15,000	111°	90°	82.5°	+0.70°	+7.7%
10	Petroleum Refinery—Gulf Coast	36,570	120°	90°	82°	—0.60°	—4.4%
11	Power Plant—Southwest	70,450	102.6°	86°	70°	—0.86°	—4.4%
12	Power Plant—Southwest	70,450	102.6°	86°	70°	—0.51°	—2.7%
13[2]	Power Plant—East Central	13,000	101°	85°	75°	—3.70°	—24.3%
14	Power Plant—Mid-Central	44,000	100°	86°	74°	+0.45°	+4.0%
15	Power Plant—South Central	83,000	108.1°	90°	76°	—0.80°	—4.3%
16	Chemical Plant—South	40,000	103.3°	85°	78°	—0.30	—3.0%
17	Power Plant—North Central	37,000	100.5°	83°	72°	+1.20°	+9.6%
18	Petroleum Refinery—East Coast	15,570	115°	85°	76°	+1.10°	+9.0%
19	Power Plant—Mountain States	65,000	101.7°	82°	63°	+0.78°	+4.1%
20	Chemical Plant—Gulf Coast	40,750	123°	90°	80°	—0.16°	—1.2%
21	Chemical Plant—Gulf Coast	11,000	116°	90°	80°	+1.80°	+13.2%
22[3]	Retest of Tower Reported in No. 14	44,000	100°	86°	74°	+0.45°	+4.0%
23[4]	Retest of Tower Reported in No. 11	70,450	102.6°	86°	70°	+0.20°	+1.1%
24[4]	Retest of Tower Reported in No. 12	70,450	102.6°	86°	70°	+0.33°	+1.8%
25	Petroleum Refinery—East Central	6,000	125°	90°	75°	—0.46°	—2.6%
26[5]	Petroleum Refinery—Gulf Coast	10,000	120°	85°	79°	+0.30°	+3.2%
27	Power Plant—Southwest	72,000	112°	92°	78°	+1.05°	+6.6%
28	AEC—East Central (1 of 2 duplicate units)	62,798	132.3°	90°	80°	+0.31°	+3.5%

NOTES: 1) Plus indicates capacity exceeding specified performance; minus denotes deficiency. 2) Tested to determine loss of performance due to extensive settling of basin and resultant misalignment of structure. 3) Retested at higher wet bulb. 4) Retested at contract (higher) horsepower. 5) Tested in accordance with Cooling Tower Institute test procedure (ATP-105 adopted May 1, 1955) and observed by CTI representative.

HERE IS THE RECORD — a consecutive list of ALL acceptance tests conducted by Marley during the 1954-1955 test seasons. All are full-scale tests conducted in strict accordance with specified methods.

Towers tested were of many sizes and capacities, operating under widely varying conditions. Geographically, these tests spanned the entire country and included towers sold since 1950, located at elevations up to 5,000 feet.

HERE IS THE RECORD that offers **more positive assurance of performance satisfaction than any guarantee ever written.** It shows why Marley has the complete confidence to insist that you TEST YOUR TOWER.

MARLEY

The Marley Company

Founder-Member Cooling Tower Institute

Kansas City, Missouri

Released for the first time at Geneva

Research and engineering methods and data

to aid in greater development of

SCIENTIFIC AND INDUSTRIAL USES OF ATOMIC ENERGY

JUST OUT

6 volumes prepared by the U. S. ATOMIC ENERGY COMMISSION

RESEARCH REACTORS
406 pages, 7⅞ x 10¼, illustrated, $6.50
Detailed descriptions, complete with selected design drawings, of six types of United States research reactors now in use.

REACTOR HANDBOOK: PHYSICS
804 pages, 7⅞ x 10¼, illustrated, $12.00
Discussion of reactor physics and nuclear-design data, including shielding theory and calculating techniques.

REACTOR HANDBOOK: ENGINEERING
1088 pages, 7⅞ x 10¼, illustrated, $15.00
Review of reactor technology, including basic reactor systems applicable in power development and a summary of experimental reactor designs.

REACTOR HANDBOOK: MATERIALS
614 pages, 7⅞ x 10¼, illustrated, $10.50
Data and background information on reactor materials; fuels and moderators, and shielding, structural and miscellaneous materials.

NEUTRON CROSS SECTIONS
363 pages, 15¾ x 10¼, profusely illustrated, $12.00
Recent compilations of neutron cross-section data affecting reactor design.

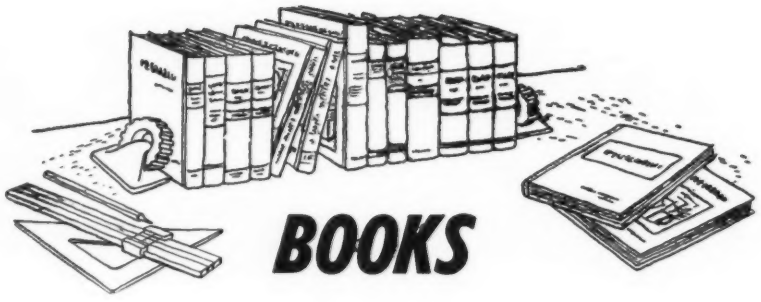
CHEMICAL PROCESSING AND EQUIPMENT
316 pages, 7⅞ x 10¼, illustrated, $6.00
Process and engineering description of a separation system, together with a catalogue of special equipment for the handling of radioactive materials.

HERE is an immensely valuable reference for all who work with nuclear energy. Information released by the Atomic Energy Commission shows much concerning the ways in which fissionable materials can be put to work in nuclear reactors for research purposes and for the production of power and radioisotopes.

Prepared as a contribution to the nations represented at the Geneva Conference, August 1955, to aid world-wide advance in the beneficial use of atomic energy, the information now is available to scientists and engineers of the United States, in six technical-engineering volumes published by McGraw-Hill.

These books are representative of the great strides already made in putting atomic energy to work in industry, agriculture, medicine, and research. They contain technical information and ideas that can contribute to even greater progress in the future. See what specific value they may hold for you —send the coupon to see any or all of the books on approval for 10 days.

Mail your order to
CONSULTING ENGINEER
227 Wayne Street **St. Joseph, Mich.**



BOOKS

TO ORDER BOOKS

As a readers' service, CONSULTING ENGINEER will order reviewed books or any other technical volumes you need. In ordering books, give title, author, and publisher and enclose check. We will also suggest titles of books on any technical subject and order for you at regular publishers' prices.

PROFESSIONAL ENGINEERING REGISTRATION LAWS, a compendium by A. L. McCawley; Carthage Press Printers; 614 pp; $8.75.

Reviewed by Wesley Bintz
Consulting Engineer

These laws begin with the Wyoming law, passed in 1907, and end with the law passed by the District of Columbia in 1950. Registration in all 48 states and Hawaii and Puerto Rico is discussed.

It is thought by this reviewer that this compendium can, and should be used by the states to make these laws more uniform and at the same time stronger, and ultimately to set up better procedures for registration on an interstate basis.

The author points out that since the National Society of Professional Engineers helped in preparation of the book, they should be interested in keeping this type of material on hand and up to date.

The initial pages explain how to use the book. All state laws are given in complete form with an explanation of each section of the laws, such as: legislative authority, official titles, purposes, definitions, qualifications, examinations, forms, permits, reciprocity, exemptions, seals, legal aspects, powers, etc.

A reprint of the South Dakota Law, passed in 1925, and revised in 1954, is included to show how the author feels this book should be kept up to date. Canadian registration laws are also listed.

In the opinion of this reviewer the book is an excellent book for the file of anyone interested in practicing in more than one state. It is well worth its cost to protect that individual against starting work in another state before he knows how the laws read, and how they may be interpreted.

FILMS

"SOIL-CEMENT FOR LOW-COST PAVING," Portland Cement Association, 16 mm, sound and color, 21 minutes.

This film shows examples of soil-cement roads, streets, airports, and parking areas and includes an explanation of what the material is, its properties, its engineering characteristics, and its application to various types of paving situations.

•

THE PHOTOGRAPHIC PRODUCTION OF SLIDES AND FILM STRIPS, Eastman Kodak Company; 52 pp; $.50. This book is designed to help the business and industrial photographer carry out necessary steps in transforming flat copy and photographs to a filmstrip or slide sequence. Included is a list of some of the companies that supply equipment useful for slide and filmstrip production such as cameras and accessories, printers, and processing equipment.

Expert Witness Reprint

Robin Beach's five articles on "The Engineer as an Expert Witness" are available in a 16-page reprint for $1.00. Please write to: Reader Service Dept., CONSULTING ENGINEER, 227 Wayne St., St. Joseph, Mich.

Consulting Engineer Editorial Index, 1955

A

Air Pollution

Air Pollution Control, William G. Christy, p38 April

Atomic Energy

Can You Afford to Ignore Atomic Energy?, Philip D. Bush, p40 October

Consultants and Atomic Power, Philip D. Bush, p48 July

Disposal of Radioactive Waste: Part I . . . The U. S. Approach, Bernard Manowitz; Part II . . . The British Approach, Leo Walter, p36 December

Specifying Canned Motor Pumps, Staff, p62 September

The Geneva Atomic Conference, Fritz Hirschfeld, p67 September

Why We Are in Atomic Energy, C. R. Barthelemy, p38 May

Will Nuclear Power Promote Public Ownership?, Albert Lepawsky, p30 August

Your Place in Atomic Energy, James K. Pickard, p34 February

Automation

Analyzing an Automation Project, C. E. Evanson, p55 November

Automation Consulting, Herbert S. Kindler, p59 April

Data Handling Systems, S. D. Ross, p59 July

Your Clients Need Help With Automation, C. E. Evanson, p43 August

Your Stake in Automation, C. E. Evanson, p56 July

B

Boilers (see Power Plants)

Bolts vs Rivets (see Structural)

Bridges (see Highways & Bridges)

Budget (see Cost Analysis)

Building Skins (see Materials of Construction)

C

Civil Engineering

Designing Highway Interchanges, Arthur W. Keith, p41 April

St. Lawrence Seaway Economics, John S. G. Shotwell, p26 Feb.

Thin Shell Roofs for Large Buildings, Felix Candela, p53 May

Concrete Construction

Designing Highway Interchanges, Arthur W. Keith, p41 April

Consulting Engineer-Architect Relationship

How About Alternate Designs?, Paul Rogers, p38 June

Consulting Engineer-Contractor Relationship

How About Alternate Designs? Paul Rogers, p38 June

These Contract Terms Got Action, Norris Matthews, p38 November

Controls (see Instruments & Controls)

Competitive Bidding (see Fees)

Corrosion

Preparing Specifications for the Painting of Steel Structures, Joseph Bigos, p65 October

Cost Analysis

Depreciation, Harold Bland, p44 May

The Operating Budget, Henry Keyserling, p53 April

D

Depreciation (see Cost Analysis)

Drafting (see Office Standards & Organization)

E

Economics

The Economic Outlook, E. F. MacDonald, p47 January

Electrical Distribution

Establishing an Industrial Electrical System, Herve H. Hunt, p48 April

Noise Levels of Indoor Transformers, T. R. Specht, p50 October

Shawnee's Supervisory Control System, Raymond M. Alspaugh, p50 August

Take A Look at Power Factor, Harold E. McConnell, p62 June

Electrical Engineering

Establishing an Industrial Electrical System, Herve H. Hunt, p48 April

Pipeline Network Computors, Dr. Sheldon L. Levy and Leon D. Findley, p58 June

Take a Look at Power Factor, Harold E. McConnell, p62 June

Electrical Equipment

Cooling Techniques for Large Generators, L. T. Rosenberg, C. E. Kilbourne, and W. C. Brenner, p42 February

Noise Levels of Indoor Transformers, T. R. Specht, p50 October

Permanent Magnets, Staff, p47 September

Pumps — With no Moving Parts, Glenn Murphy, p34 March

Shawnee's Supervisory Control System, Raymond M. Alspaugh, p50 August

Elevators

Hydraulic Elevators and Modern Building Design, Floyd E. Willison, p52 December

Engineering Societies (see Professional Development)

Ethics

A Matter of Ethics, Staff, p78 February, p70 March

A Practical Approach to Ethics, Clement J. Freund, p50 May

Are You a Consultant or a Broker?, M. Brenner, p55 January

Ethical Practices, Clement J. Freund, p53 July

Should Professional Engineers Advertise?, Richard L. Moore, p60 November

Why Cannons of Ethics?, William F. Ryan, p40 January

European Reports

Dutch Consultants Cooperate on Foreign Jobs, Fritz Hirschfeld, p45 Dec.

Report From Ankara, Fritz Hirschfeld, p30 June

Report From Athens, Fritz Hirschfeld, p16 August

Report From Britain, Fritz Hirschfeld, p86 September

Report From Frankfurt, Fritz Hirschfeld, p80 May

Report From Holland, Fritz Hirschfeld, p34 October

Report From Istanbul, Fritz Hirschfeld, p16 July

Report From Madrid, Fritz Hirschfeld, p68 December

Report From Paris, Fritz Hirschfeld, p32 March

Report From Stockholm, Fritz Hirschfeld, p64 November

The Geneva Atomic Conference, Fritz Hirschfeld, p67 September

Expansion Joints (see Piping)

Expert Witness

Fees and Contracts for the Expert Witness, Robin Beach, p38 August

Ground Rules for the Expert Witness, Robin Beach, p41 June

The Engineer-Expert Under Cross Examination, Robin Beach, p38 March

F

Fees

Fees and Contracts for the Expert Witness, Robin Beach, p38 August

Fee Schedules for Swiss Consultants, Fritz Hirschfeld, p61 Oct.

Setting Your Fee, David C. Pfeiffer, p34 January

Survey of the Profession, Staff, p26 January

Foundations (see Soil Mechanics)

Fuel (see Power Plants)

H

Highways & Bridges

Designing Highway Interchanges, Arthur W. Keith, p41 April

I

Income for Engineers (see Fees)

Industrial Waste Disposal (see Waste Disposal)

Instruments and Controls

A Simplified Symbol System, H. H. Johnson, p47 May

Data Handling Systems, S. D. Ross, p59 July

Pipeline Network Computors, Dr. Sheldon L. Levy and Leon D. Findley, p58 June

Shawnee's Supervisory Control System, Raymond M. Alspaugh, p50 August

Techniques of Telemetering, S. D. Ross, p60 March

Insurance

Liability Insurance for Engineers, Clarence T. Hubbard, p46 April

L

Legal Aspect

Air and Water Pollution: The Nuisance Doctrine, Melvin Nord, p21 December

Labor Law in Perspective, Melvin Nord, p24 November

Labor Law: Historical Background (I), Melvin Nord, p23 June

Labor Law: Types of Economic Pressure Exerted by Unions (II), Melvin Nord, p20 July

Labor Law: Types of Economic Pressure Exerted by Unions (III), Melvin Nord, p21 August

Liability of the Master, Melvin Nord, p16 March

Master's Liability for Injuries to Servant, Melvin Nord, p20 April

Master, Servants, Contractors, Melvin Nord, p14 February

Patents, Copyrights, Trademarks, Melvin Nord, p14 January

The Effect of Legislation on Labor Law, Melvin Nord, p34 Sept.

The Effect of Legislation on Labor Law (II), Melvin Nord, p28 Oct.

Workmen's Compensation, Melvin Nord, p20 May

M

Magnets

Permanent Magnets, Staff, p47 September

Management Engineering

Management Engineers . . Competitors or Collaborators, Kenneth J. Eaton, p55 March

New Ideas for Warehouse Design, William H. Meserole, p48 March

Management Training (see Office Standards & Organization)

Materials of Construction

More Than One Way to Skin a Building, Robert K. Posey, p43 July

Putting Plastics in Their Place, Joseph A. Snook and Raymond B. Seymour, p46 August

Zirconium—Metal With a Future, Frank Charity, p56 October

Mechanical Engineering

Cooling Techniques for Large Generators, L. T. Rosenberg, C. E. Kilbourne, W. C. Brenner, p42 February

Metals

Electric Spark Machining, Everard M. Williams and C. Paul Porterfield, p34 April

Permanent Magnets, Staff, p47 September

Zirconium—Metal With a Future, Frank Charity, p56 October

Mining & Metallurgical Engineering

Electric Spark Machining, Everard M. Williams and C. Paul Porterfield, p34 April

Getting More Coal From Austrian Mines, Walter T. Buhl, p34 May

Municipal Garbage Disposal (see Waste Disposal)

N

Noise Control

Noise Levels of Indoor Transformers, T. R. Specht, p50 Oct.

O

Office Standards & Organization

Developing Tomorrow's Management For Your Consulting Firm, Florent E. Verdin, p40 July

How Long Should He Be on the Board? John F. Lee, p40 Feb.

New Techniques Cut Drafting Costs, H. J. Reinig, p44 March

Office Standards and Organization, Raymond Dittrich, p40 May

Planning For Engineering Work, Robert B. Wilson and Robert Galloway, p50 November

P

Permanent Magnets (see Magnets)

Painting (see Specifications)

Piping

Design Data for Expansion Joints, P. R. Lutz and K. S. Roberts, p41 March

Pipeline Network Computors, Dr.

Sheldon L. Levy and Leon D. Findley, p58 June

Pipeline Design (see Piping)

Plastics (see Materials of Construction)

Power Factor (see Electrical Distribution)

Power Plants

Cooling Techniques for Large Generators, L. T. Rosenberg, C. E. Kilbourne, W. C. Brenner, p42 February

Enclosures for Vital Areas of Outdoor Power Plants, Robert H. Weight, p43 November

Getting More Coal From Austrian Mines, Walter T. Buhl, p34 May

How Many Feed Pumps Should You Specify?, Igor J. Karassik, p48 February

Shawnee's Supervisory Control System, Raymond M. Alspaugh, p50 August

Step-Up Gear Drives for Centrifugal Boiler Feed Pumps, Igor J. Karassik, p55 June

Solving Tall Chimney Design Problems, M. Zar, p48 December

These Contract Terms Got Action, Norris Matthews, p38 November

Will Nuclear Power Promote Public Ownership?, Albert Lepawsky, p30 August

Professional Development

California, Here We Come!, Asa G. Proctor, p52 January

Consulting Engineers Meet in St. Louis, Staff, p56 December

Engineers and Professional Recognition, C. W. Griffin, Jr., p42 September

Survey of the Profession, Staff, p26 January

You've Got to be a Joiner!, Staff, p44 January

Pumps

How Many Feed Pumps Should You Specify?, Igor J. Karassik, p48 February

Pumps—With No Moving Parts, Glenn Murphy, p34 March

Specifying Canned Motor Pumps, Staff, p62 September

Step-Up Gear Drives for Centrifugal Boiler Feed Pumps, Igor J. Karassik, p55 June

R

Range Finder

Games and Business Strategy, Dr. Gerald J. Matchett, p66 May, p26 July

National Debt and Stability, Dr. Gerald J. Matchett, p54 February

Stabilizing Through Taxation, Dr. Gerald J. Matchett, p22 January

Registration (see Professional Development)

Reports From Abroad (see European Reports)

Report Writing

Planning the Engineering Report, John R. Mayer, p54 October

Reports Your Clients Want to Read, Morris Sandel, Jr., p35 August

Roofs (see Structural)

S

Safety

Make Safety an Integral Part of Design, W. T. Rogers, p50 June

Sanitary Engineering

City Refuse—Burn it or Bury it, Charles D. Fridy, p54 August

Specifying Industrial Waste Treatment, R. J. Keating, p46 November

Sewage Disposal (see Waste Disposal)

Site Selection

Engineering a Site Study, Staff, p31 February

Plant Location Problems, Charles P. Wood, p34 November

Soil Mechanics

Soil Mechanics is a Science, James T. Carter, p46 October

Sound Control (see Noise Control)

Specifications

How About Alternate Designs?, Paul Rogers, p38 June

Preparing Specifications for the Painting of Steel Structures, Joseph Bigos, p65 October

Steam Turbines (see Power Plants)

Steel Work (see Specifications, Structural)

Structural

Enclosures for Vital Areas of Outdoor Power Plants, Robert H. Weight, p43 November

High-Tensile Bolts Replace Rivets, J. L. McCollough, p36 February

How About Alternate Designs?, Paul Rogers, p38 June

Solving Tall Chimney Design Problems, M. Zar, p48 December

Thin Shell Roofs for Large Buildings, Felix Candela, p53 May

Surface Water (see Water Supply)

Surveying

Profiling the Earth From the Air, W. C. Eddy, p36 July

T

Technical Writing (see Report Writing)

Telemetering (see Instruments & Controls)

Transformers (see Electrical Distribution, Electrical Equipment)

Turbo-Generators (see Electrical Equipment, Power Plants)

U

Unions

Consulting Engineers and the Taft-Hartley Act, Robley D. Stevens, p58 March

Professionalism and Unionism, N. W. Dougherty, p32 April

Survey of the Profession, Staff, p37 January

The Engineer's Unions are Here, Staff, p37 January

W

Waste Disposal

City Refuse—Burn it or Bury it, Charles D. Fridy, p54 August

Disposal of Radioactive Waste: Part 1...The U. S. Approach, Bernard Manowitz; Part II...The British Approach, Leo Walter, p36 December

Specifying Industrial Waste Treatment, R. J. Keating, p46 November

Water Supply

Solving Ground Water Problems, John R. Snell, p44 June

Waterways

St. Lawrence Seaway Economics, John S. G. Shotwell, p26 Feb.

Writing Reports (see Report Writing)

ADVERTISERS' INDEX

Ames Iron Works, Inc. 77
Anaconda Wire & Cable Company 81

Babcock & Wilcox Company ..... Third Cover
Bayley Blower Company 73
Blue Ridge Glass Corporation 7
Borden Metal Products Company 17
Bruning Company, Inc., Charles 29
Buffalo Forge Company 80

Canton Stoker Corporation 32
Clarage Fan Company 67
Clyde Iron Works, Inc. 87
Combustion Engineering, Inc. 33

Detroit Steel Products Company 65
Diamond Power Specialty Corporation 9

Ernst Water Column & Gage Company 82

Gates Engineering Company 8

I-T-E Circuit Breaker Company
Small Air Circuit Breaker Div. 10
Switchgear Div. 11

Jeffrey Manufacturing Company 15
Johnston Brothers, Inc. 82
Johnston Pump Company 14

Kaiser Company, E. B. 69

Mahon Company, The R. C. 13
Marley Company, The 85
Mercoid Corporation, The 84

National Coal Association 61
Niagara Blower Company 12
Nickel Plate Road Railroad 84
Northern Blower Company 79

Patterson-Kelley Company, Inc. 31
Pennsylvania Crusher Division 4
Pittsburgh Lectrodryer Corporation 83
Pittsburgh Piping & Equipment Company 71
Potts Company, Horace T. 74
Pyle-National Company, The ..... Second Cover

Reliance Gauge Column Company 30
Richardson Scale Company 75

Shaw Company, Benjamin F. ..... Fourth Cover
Standard Steel Spring Division 76
Superior Combustion Industries 3

Titusville Iron Works Co., Div. of Struthers Wells Corp. 28
Todd Shipyards Corporation 78
Tube Turns, Inc. 19-20

Union Pacific Railroad 22

Vogt Machine Company, Henry 63

Westinghouse Electric Corporation 23, 24, 25, 26, 27
Whitlock Manufacturing Company 34

Yarnall-Waring Company 35

consulting engineer

Sales Representatives

New York, N. Y.

Theodore E. Gordon
10 Commerce Court
Newark, N. J.
Market 3-0560

Philadelphia, Pennsylvania

David L. McKechnie
816 Lancaster Avenue
Villanova, Pennsylvania
Lawrence 5-4692

Cleveland, Ohio

O. DeWitt Young
3304 Avalon Road
Shaker Heights, Ohio
Wyoming 1-4841

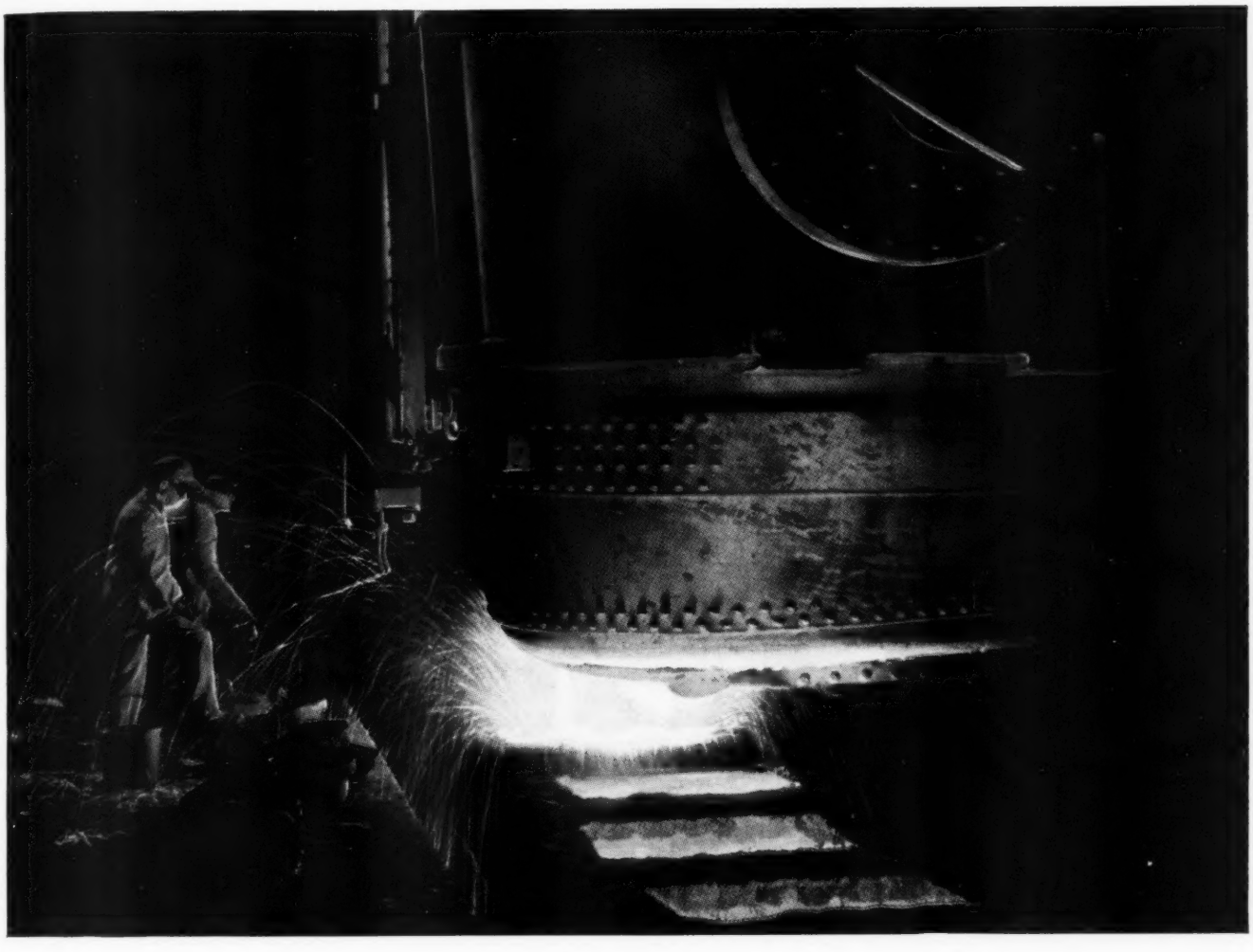
Chicago, Illinois

Ernest R. Gauley
360 N. Michigan, Rm. 614
Dearborn 2-3519

Los Angeles, California

Justin Hannon
4710 Crenshaw Boulevard
Axminister 2-9501

Sales Manager — O. D. Young



INDUSTRIES THAT MAKE AMERICA GREAT

STEEL...WHEREVER YOU TURN

Abundant, durable, versatile and comparatively cheap, steel in its many carbon, alloy and stainless forms is the most useful of all the metals at man's disposal. Unknown in nature, steel had to be created by man's ingenuity, from iron ore and other available natural materials. But only during the past 90-odd years has man discovered how to produce low-cost steel in the huge quantities which have made this the "age of steel."

Today, an estimated 1½ billion tons of steel are in use in this country. With a capacity of about 125 million net tons a year, American steel mills can produce close to half the world's annual total. Used for everything from buildings to pins, the total applications of steel are almost countless; *it is virtually impossible to find a product that does not depend on steel for its production or distribution, or both.*

Steel's steady growth reflects the importance of its contributions to America's greatness. Much credit must go to the industry itself, which did not hesitate to execute a bold post-war capacity expansion program of more than 28 million net tons at a cost of nearly 6 billion dollars. With customary foresight, the steel companies are carrying on an intensive two-fold program to develop new sources of ore. While spending hundreds of millions of dollars to open fields in Labrador and elsewhere, they are also investing heavily in engineering developments that will make it possible to use domestic low-grade ores such as taconite.

Interwoven with the history and progress of steel is the development of steam generation for power, processing and heat. B&W, through the applications of steam, has long been a partner in the vital steel industry—has brought to it boiler building experience covering almost a century, built on the results of a continuing, intensive program of research and engineering development. In steel as in all industry, improvements in steam generation will continue to make genuine contributions toward still better products and services. The Babcock & Wilcox Company, Boiler Division, 161 East 42nd St., New York 17, N. Y.

N-201

BABCOCK & WILCOX

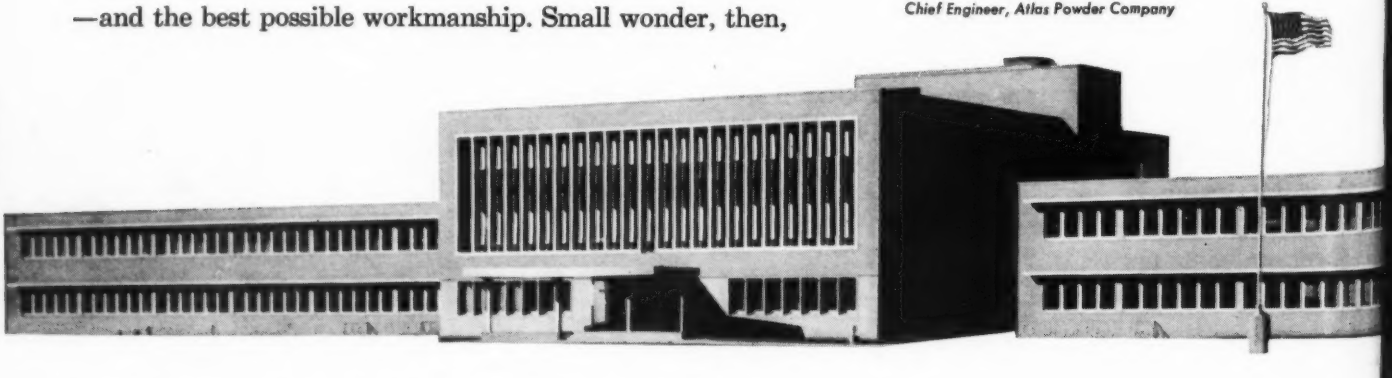
BOILER DIVISION

a time to work and a time to play

Shaw salutes Atlas Powder Company for their forward-looking philosophy which has resulted in handsome new offices for working time and modern recreational facilities for playing time. Located four miles from the center of Wilmington, Delaware, on a forty-five acre plot, the Atlas General Office Building is air- and sound-conditioned—designed for maximum efficiency and comfort. A walkway connects the General Office Building with a functional cafeteria-recreation building, where good food and good times go hand in hand. Outdoors is a large parking lot, a spacious swimming pool, tennis courts, a baseball diamond, and an attractive patio. Naturally, in planning the new offices and recreational facilities, the builders—The H. K. Ferguson Company—utilized the best obtainable materials—and the best possible workmanship. Small wonder, then,

Piping plays an extensive role in the new Atlas Building—for heating, air-conditioning, refrigeration, water and other services. We found the experience and resources of the Benjamin F. Shaw Company of major importance in completing satisfactorily—and on time—this vital phase of our project.

J. Charles Allen
Chief Engineer, Atlas Powder Company



that Shaw was chosen to fabricate and install the extensive piping for the air-conditioning, the heating, the swimming pool. Shaw's reputation for painstaking planning, skillful fabrication, and dependable installation is world-wide . . . and well-earned. Whatever your piping requirements, look to Shaw to fulfill them—carefully, reliably, economically.

SHAW